Enciclopedia en Español de Maquinaria para Minas, Pagina 60

NOV 25 METALS & MINING

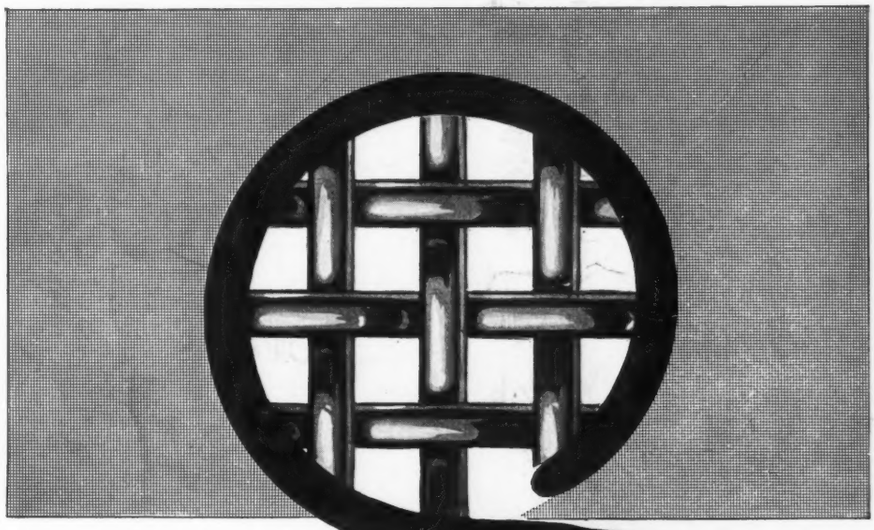
# Engineering and Mining Journal

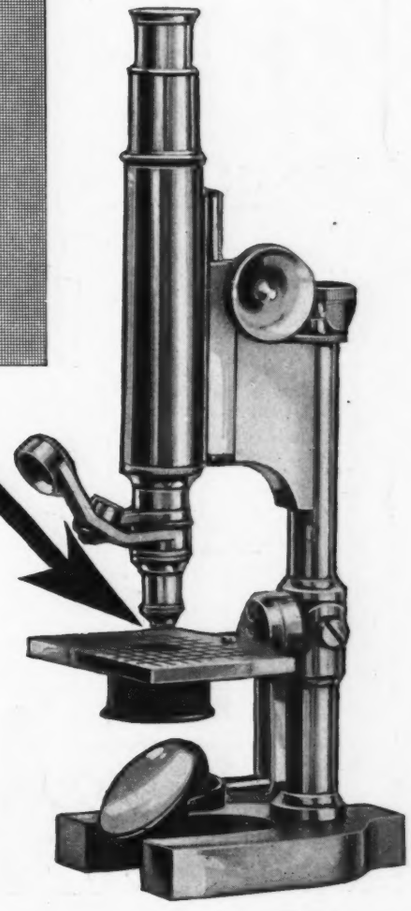
Volume 102, No. 22
Issued Every Saturday
Hill Publishing Company

NEW YORK, NOVEMBER 25, 1916

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

## Screens of Great Accuracy—
### 10 to 350 Mesh—Immediate Deliveries





### The Microscope Tells The Story

Glue your eye to a powerful microscope and all our screens, including the very finest, show a flawless weave, geometrically square meshes, the same count in warp and shoot and wires of the same gauge in both directions. We specialize on fine screens, always available for immediate shipment.

Vanadium **Steel** Screens, up to 250 mesh.

Vanadium **Bronze** Screens, from 10 to 350 mesh; the finest mining screen cloth ever made and the exclusive product of our works.

SCREENS in pure nickel, German silver and monel metal up to 260 mesh. **Metallic Filter Cloth** of all characters. **Standard Laboratory Testing Sieves,** 10 to 350 mesh, carried in stock. All our Wire Cloth is furnished in sizes and shapes to suit. Get in touch with us.

**Multi-Metal Separating Screen Company**
**253 W. 19th Street - - - New York City**

# The S-A Page

**Published Weekly in the Interests of S-A Conveying Engineering**

## Smelter, Concentrator and Mine Owner

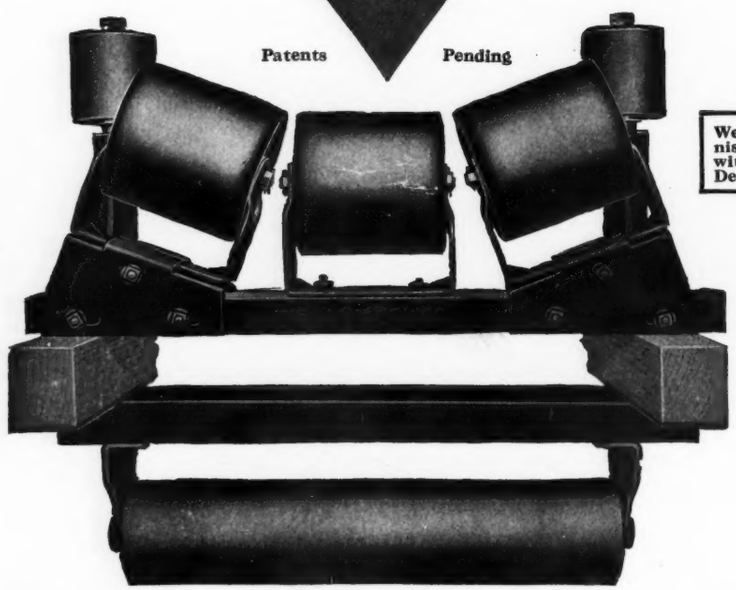
We want you to be judge, jury, prosecuting attorney—in fact the whole court—in proving in your own way under your own conditions our claims for the Unit Carrier. Send for a free sample Unit Carrier stating size of belt conveyor you are now using.

An "S-A" Unit Carrier for Belt Conveyors will run from six to twelve months without lubrication and without attention; it saves power and saves the conveyor belt as well; it is interchangeable.

Remember the experience of the "S-A" Engineering Department is based on thousands of successful installations. This department is maintained for cooperative service of our customers without obligating them in the least. Difficult conveying problems may be put up to us with the confidence that any designs submitted will not only be adequate, but will secure minimum conveying costs. Send for your copy of "S-A Labor Saver," our interesting magazine—free for the asking.

## Ball Bearing Steel Thru-out

Patents Pending



**We are now prepared to furnish Unit Carriers equipped with Hyatt Roller Bearings. Detailed announcement later.**

## For Belt Conveyors

## Stephens-Adamson Mfg. Co. - Aurora, Ill.

**Conveying, Screening**

50 Church Street.....New York, N. Y.
First National Bank Bldg.....Chicago, Ill.
H. W. Oliver Bldg.....Pittsburgh, Pa.
Federal Reserve Bank Bldg.....St. Louis, Mo.
First National Bank Bldg., Huntington, W. Va.
503 Dooly Block.....Salt Lake City, Utah
J. W. Gates, District Manager.

**Branches:**

79 Milk St.....Boston, Mass.
Colwell & McMullin, District Managers.
824 Dime Bank Bldg.....Detroit, Mich.
310 Stair Bldg.....Toronto, Ont.
E. J. Banfield, Agent.

Cable Address.....Saco

**Transmission Machinery**

So. African Agent....J. MacG. Love & Co., Ltd.
1 and 3 London House, Loveday Street, Johannesburg, So. Africa.
Australian Agent.....Arthur Leplastrier & Co.
Circular Quay East, Sydney, Australia.
Scandinavian Agent.....C. S. Christensen, A/S
Post Box 85, Kristiania, Norway.

Engineering and Mining Journal

VOLUME 102 NOVEMBER 25, 1916 NUMBER 22

# The Nevada Wonder Mill

By Arthur C. Daman*

*SYNOPSIS—A ten-stamp cyanide mill that was constructed to handle 75 tons per day has, by some minor changes in solution handling and some small additions to tank capacity, been made to treat 155 tons per day—sometimes more. Power consumption is 27.7 kw.-hr. per ton milled, and 10 tons per day per man is handled.*

The ore of the Nevada Wonder Mining Co., at Wonder, Nev., is milled by the Churchill Milling Co., which is a subsidiary controlled by the same interests.

The crushing of the ore is done with a 10x16-in. Blake crusher, ten 1,400-lb. stamps, one 6-ft. Trent chilean mill and one 5x22-ft. tube mill in closed circuit with a Dorr duplex classifier. The screens used on the batteries have ½x1-in. openings, the stamp duty being as high as 16 tons per day, with a yearly average of 15.7 tons. The ore is principally one of silver and averages between $15 and $25 per ton. The average tonnage for nine months of 1916 has been 157 tons per day, which is remarkable considering that the mill was designed for but 75 tons and only a few changes have been made in the solution equipment, and at the same time securing a recovery above 90%.

Since the excellent paper on the Churchill Milling Co.'s mill, by E. E. Carpenter, read before the American Institute of Mining Engineers, in San Francisco, 1915, some additions have been made to the mill, such as one 28x100-ft. Dorr thickener between the agitator and the stock tank; one clarifying tank, one battery storage tank and two zinc boxes. The pulp, upon leaving the agitators, has a fresh wash of barren solution in each of the four Dorr thickeners before entering the stock tank. By using a fresh barren wash for each thickener instead of the countercurrent-decantation system, the extraction is increased, but the cyanide loss is also increased. From 1,200 to 1,300 tons of solution is precipitated in the 9 zinc boxes each day. The lime is slacked and ground in a small chilean mill and added intermittently to the pulp entering the first Pachuca tank. It was found that only three tanks were needed for agitation, and at present the fourth is used as a settler, the decanted solution being precipitated. To prevent heavy material from settling on the sides of the Pachuca tank, a cut is made of the heavy sands as they flow over the edge of the funnel and carried to the next in series. Also every day a violent agitation of each Pachuca by high-pressure air is resorted to, so that very little trouble with the Pachuca has been encountered.

THE MILL OF THE CHURCHILL MILLING CO., WONDER, NEV.

The solution strength in the Pachuca tank is kept about 3½ lb. KCN and 2 lb. CaO. Lowering the strength of cyanide was tried, but a hard, white, crystalline coating formed on the zinc shavings with a resulting steady increase in value of the zinc-box tailings. About 220 lb. of sodium cyanide per day is added to the Pachuca tank

*Mining engineer, 2678 Eudora St., Denver, Colo.

and 150 lb. to the clarifying tanks. By keeping the precipitation heads at about 3½ lb. KCN, no difficulty in precipitation was encountered and tails averaging less than 10c. are obtained.

The zinc shavings used are very coarse, being more than $^1/_{125}$ in. wide. The efficiency of the zinc was materially increased by clarifying the solution from the Dorr thickeners for precipitation by means of Butters filters. Unclarified, 1 lb. of zinc shavings precipitated 9 oz. of metal, but when the solution was clarified, the same amount of zinc precipitated 15.39 oz. of metal. The average consumption of supplies per ton of ore for the first nine months of 1916 was:

CONSUMPTION OF MATERIALS IN CYANIDING

| | Per Ton Milled |
|---|---|
| Sodium cyanide | 2.05 lb.* |
| Lead acetate | 1.35 lb. |
| Lime | 3.69 lb. |
| Zinc | 1.45 lb. |
| Pebbles | 3.31 lb. |
| Fuel (heating) | 1.85 gal. |
| Power (milling only) | 27.7 kw.-hr. |
| Tonnage per day | 157 |
| Tons solution precipitated per day | 1,200-1,300 |
| Tons solution precipitated per ton ore, approximately | 8 |

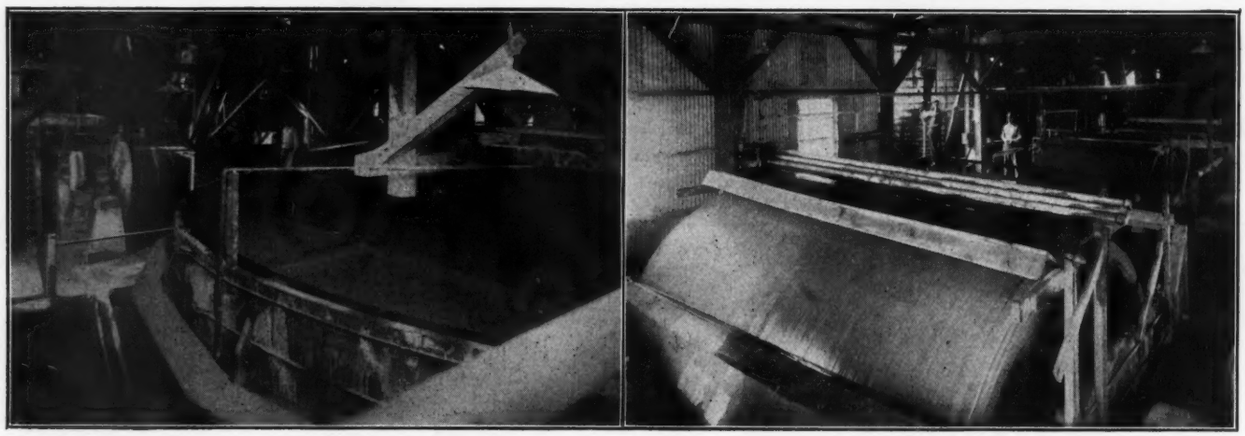
*1 lb. chemical, 1.05 lb. mechanical.

MILL-POWER DISTRIBUTION

| | % | Kw.-Hr. for 1 Ton |
|---|---|---|
| Crushing and conveying | 3.0 | 0.831 |
| Stamps | 12.0 | 3.324 |
| Chilean mill | 14.0 | 3.878 |
| Tube mill | 25.0 | 6.925 |
| Agitation | 23.0 | 6.371 |
| Thickening and washing | 5.0 | 1.385 |
| Filtering | 14.0 | 3.878 |
| Precipitation | 1.0 | 0.277 |
| Refinery | 0.5 | 0.1385 |
| Assaying | 0.5 | 0.1385 |
| Surface plant | 2.0 | 0.554 |
| Total | 100 | 27.7 |

From the mill-power table it will be seen that the crushing uses 54% of the entire power. A total of 300 hp. is represented by the motors in the mill.

The mill has an elaborate system of pipes and pump connections, thus providing for the ready interchange of solutions and pulps without any delay. All the Dorr thickeners have platforms of 2x12-in. plank encircling them, as shown in photograph. These platforms enable the millman to clean his launders or skim off any part of the thickener surface. The regular spray system is not used on the Oliver filters, but water flowing from a perforated 2-in. pipe upon a wooden shelf sprays over the pulp surface. The spray arrangement and the rubber apron used to deflect the excess surface water of the Oliver from entering the filter box are shown clearly in the illustration. By means of the rubber apron the building up of mill solutions is avoided.



Tube mill and thickener — The Oliver filters

INTERIOR VIEWS OF THE CHURCHILL MILL, WONDER, NEV.

Squirrel-cage induction motors of 440 volts are used exclusively in the mill. The accompanying table shows the various motors with the load on each:

TABLE SHOWING MOTOR DISTRIBUTION

| Motor | Rated Hp. of Motor | R.P.M. of Motor | Hp. to Drive Line Shaft | Hp. to Drive Individual Part | Total Hp. Load on Motor |
|---|---|---|---|---|---|
| Crusher and conveyor | 20 | 900 | 6.33 | ..... | 18.75 |
| Dorr thickener No. 5 | 5 | 1,200 | .... | ..... | 1.17 |
| 10 stamps (1,400 lb.) | 30 | 1,200 | 4.7 | 23.46 | 28.16 |
| Tubemill | 100 | 1,200 | 16.4 | ..... | 106.77 |
| Dorr classifier | ... | .... | .... | 5.9 | ..... |
| Chilean mill | ... | .... | .... | 36.36 | ..... |
| Tubemill | ... | .... | .... | 48.11 | ..... |
| 4-in. slime pump (centrifugal) | 20 | 900 | .... | ..... | 12.9 |
| 2½-in. slime pump (centrifugal) | 15 | 1,200 | .... | ..... | 11.0 |
| Compressor | 50 | 1,200 | 5.63 | ..... | 46.84 |
| Mill compressor | ... | .... | .... | 34.16 | ..... |
| Vacuum pump | ... | .... | .... | 3.5 | ..... |
| Zinc lathe | ... | .... | .... | 3.55 | ..... |
| Thickener | 20 | 900 | 6.0 | ..... | 17.00 |
| 4 Dorr thickeners and stock | ... | .... | .... | 5.00 | ..... |
| Triplex and centrifugal pump | ... | .... | .... | 6.00 | ..... |
| Filter | 30 | 1,200 | 3.5 | ..... | 21.12 |
| Vacuum pump | ... | .... | .... | 1.78 | ..... |
| 2½ - in. centrifugal pump | ... | .... | .... | 5.86 | ..... |
| Vacuum pump | ... | .... | .... | 8.80 | ..... |
| 3 Oliver filters | ... | .... | .... | 1.18 | ..... |
| Pump | 10 | 1,200 | .... | ..... | 8.89 |
| Triplex pump | ... | .... | .... | 5.39 | ..... |
| Triplex pump | ... | .... | .... | 3.5 | ..... |

The mill crew consists of three batterymen, one crusherman, three solution men, three solution helpers, three refinery men, one utility man, one mechanic and helper and the mill foreman, making a total of 16 men per day, equivalent to 10 tons per man per day.

All mill data—assay values, tonnage, etc.—are posted in the mill so as to give all millmen a knowledge of the mill results. An accurate and uptodate record is kept of all results obtained and shows very interesting details of milling.

I am indebted to E. E. Carpenter, general superintendent, and H. M. Alley, mill foreman, for the data incorporated in this article.

**The Bolivian Mineral and Natural-Products Exhibit,** shown at the Panama-Pacific Exposition in San Francisco, has been set up in New York as a permanent exhibit, to be maintained in connection with the new offices of the consul general, Adolfo Ballivian, on the 41st floor of the Woolworth Building.

# Winona Copper-Leaching Test Plant

A 5-ton Slater-process leaching plant at Winona, Mich., has been in operation for some months and has yielded interesting results.

The ore milled by the Winona Copper Co. is an amygdaloid which greatly resembles that mined from the Baltic and other beds of the Lake Superior native-copper deposits. It carries considerable epidote, calcite and quartz, with a limited amount of mass and barrel copper, the bulk of the metal occurring in stamp rock.

In the plant in question two classes of mill tailings have been treated, each being amenable to leaching and apparently to the same degree. Of these the first comprises the tailings from the Hardinge-mill middling tables and from the slimes middling tables, eight tables in all, and the second class consists of the tails from the middling table. The bulk of this material is discarded ordinarily in the mill tailings.

The majority of the tests have been made on a composite pulp derived from the middling tables, the results and corresponding deductions being based upon the handling of this material.

## Machinery for Handling the Pulp

A cone classifier is used for partly dewatering the pulp, which then flows to a Dorr simplex classifier. The latter reduces it to about 20 to 22% moisture, dropping the heavy pulp directly into the feed end of a barrel agitator, where it meets with fresh leaching solution.

The agitator, an iron shell lined with acid-proof brick set in hot asphalt, is provided with two wooden baffles which are believed to assist in bringing about a good contact between the ore and the solution. The proper weight ratio of solution to ore depends upon the strength of the former, being usually about 2.5 to 1, and the solution and ore are in contact in the agitator for about 1½ hr.

The agitator discharges into the lowest stage of a three-deck Dorr classifier which washes and also dewaters the pulp, the pregnant solution being replaced at four points by barren solution.

From the lowest deck the pulp, retaining but 20 to 22% moisture consisting of barren solution, is discharged into a tailings launder, whence it is flushed to the regular mill-tailings launder by mill water from the cone classifier at the head of the system and the overflow from the upper Dorr classifier.

## Machinery for Handling Solutions

There are five simple-diaphragm electrolytic cells built of wood and painted with an acidproof asphaltum mixture, each with a capacity corresponding to the extraction of 20 to 25 lb. of copper per 24 hr.; and in which two solutions are employed.

The catholyte solution, which passes through the cathode compartment, is a 5 to 10% solution of common salt which gradually becomes charged with sodium hydroxide.

The anolyte solution, which passes through the anode compartment, is barren leaching solution that has passed through the system and is a 5% salt solution containing also about 0.2% iron as ferrous chloride. The cathodes are of iron and the anodes of Acheson graphite. The catholyte passes through its compartment and back to its storage tank, while the anolyte passes through its corresponding compartment and through the entire leaching system at a rate sufficient to provide the required ratio of solution to ore.

In passing through the electrolytic cell the iron in the anolyte is changed from ferrous chloride to ferric chloride and a slight excess of free chlorine is also formed, as well as some other chlorine compounds such as hypochlorous acid. The aggregate of these materials constitutes the active leaching agent, or fresh leach.

The current employed is adjusted to meet the conditions. For "10-lb. ore," using five cells and a solution-ore ratio of 2.5 to 1, with six tons of dry feed per day, each cell should receive about 175 amp.

In the test plant it was found desirable to place the revolving copper precipitator above the level of the discharge of the agitator. Hence it was necessary to elevate the pregnant solution by means of a special acid-proof pump.

Where sufficient grade is available, a single-stage plant may be designed so that only the catholyte and the barren solution, neither of which appreciably attacks iron, will require to be pumped.

Since all solutions are in constant motion when the plant is in operation, storage necessitates are at a minimum. Two tanks each are provided for catholyte and anolyte: A sump tank for the former just below the level of the cells and one for the latter just below the copper precipitator, and a supply tank for each above the level of the cells. In addition to these four tanks, there is one for settling the pregnant solution before precipitation of the copper, and one between the precipitator and the barren-solution sump, acting as a copper filter and settler.

For handling fresh leach and pregnant solution, the pipes used are of acidproof fiber. For all other solutions ordinary iron pipe is satisfactory.

In the 6-ton plant, all the machinery is driven from a single countershaft and from 10 to 15 hp. is used, but it is estimated that 40 hp. would operate a 100-ton plant.

Current is supplied to the cells by a d.-c. generator, the voltage depending upon the number of cells placed in series. With five cells and a 5% salt solution for the anolyte, about 22 volts are needed.

## Operation of the Plant

To begin operations, the compartments of the electrolytic cells are filled from the respective supply tanks and, when nearly full, current is turned on. When the compartments are filled, the flow of catholyte is reduced to a minimum and a flow meter controlling the anolyte is adjusted to give the proper volume of solution.

The pumps are then started and pulp from the mill turned into the upper Dorr machine. The plant may be said to be entirely automatic when once the flow meter and the stream of mill pulp have been properly adjusted, it being believed that one man can run a 100-ton plant, doing in addition all the analytical work that may be necessary. His principal duties would be to oil the machinery, regulate the flow of pulp and solutions, supply scrap iron to the precipitator, clean up cement copper from the copper boxes and occasionally to sluice out the pregnant-solution settling tank.

With a single-stage leach, handling six tons of solids and 12 to 15 tons of solution per day, the extraction is about 75% on material carrying 9 to 12 lb. copper per

ton, but it may be raised to 85% by allowing a longer contact between ore and leaching solution, with a consequent lower daily capacity.

With a 75% extraction in a single-stage plant, the power consumption for the regeneration of the leach is from 1.75 to 2 kw.-hr. and the iron consumption about 1.25 lb. per pound of copper produced, the salt loss in the tailings being from 20 to 22 lb. per ton of material handled, regardless of copper content.

The results attained in the tests indicate that a two-stage leaching process should be adopted; pregnant leach, partly exhausted, to be used for fresh ore, and fresh leach direct from the cells for the secondary stage of leaching.

Tests conducted in large bottles rotated at about the same rate as the barrel agitator and using pulp and solution from the 6-ton plant confirm the belief that with the proposed two-stage process the extraction on any ore will be higher, with equal solution volumes and ore weights.

About 25% of the total amount of copper extracted is removed during the first stage, and it is expected that a total extraction of 90% of the ore content can be obtained with a power consumption of from 1.5 to 1.6 kw.-hr. per pound of copper extracted, which is appreciably lower than obtained in the single-stage process. The principal extra equipment required would be an agitator and an acidproof pump to handle pregnant solution.

### Installation and Operating Costs

It has been estimated that the cost of equipment for a 100-ton two-stage leaching plant at Winona, including 20 electrolytic cells, 100-kw. generator and motor, 4½x 15-ft. dewaterer, acidproof duplex machine to be used as agitator, barrel agitator, three-deck Dorr machine for washing and dewatering, woodwork and mounting classifiers, two iron pumps, one acidproof pump, tanks, pipe and pipe-fittings, 40-hp. motor, countershaft and fittings, and precipitator and fittings, will amount to approximately $25,000 as the cost of the complete plant.

Assuming the cost of power as 0.8c. per kw.-hr., with salt at $5 and scrap iron at $10 per ton respectively and with labor at an average of $3 per day, the operating costs in cents per pound of copper produced, based on an ore from which 10 lb. copper per ton is recovered, have been estimated as follows: Power for electrolysis, 1.28c.; power for machinery, 0.58c.; salt loss, 0.50c.; iron for precipitation, 0.63c.; labor, 1.35c.; supplies and repairs, 0.50c.; or a total of 4.84c. per lb. To this should be added interest and amortization on the cost of the plant, which at 12% per annum on $25,000 is calculated to amount to 1c. per lb. of copper, making the total estimated cost at Winona, 5.84c. per lb. of cement copper 75 to 80% pure.

Without any change whatever in the operation of the mill, there will be available about 100 tons per day of material carrying an average of from 10 to 12 lb. of native copper per ton, ordinarily discarded in the mill tails.

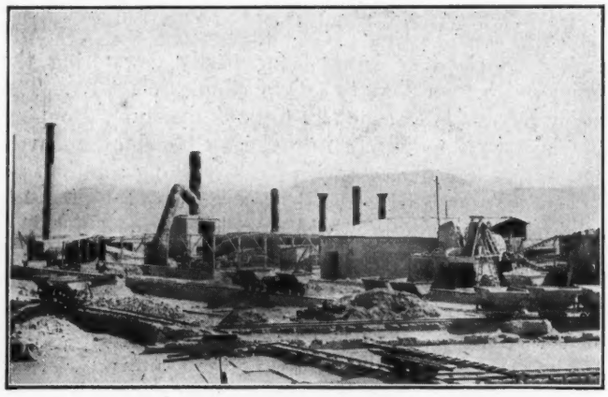
There seems to be no question regarding the feasibility of leaching Winona mill tailings to the amount of at least 100 tons per day, with an extraction approaching 90% and an operating cost of not over 5c. per lb. of cement copper produced. The total cost of the copper, refined and marketed, apparently will not exceed 7.5c. per pound.

## The Calama Smeltery

Santiago Correspondence

The smeltery and mining properties of the Compañía Minera de Calama have finally been taken over by the yankees, and a property that has off and on made money for its stockholders will finally be submerged in the Chuquicamata promotion.

The mines at Chuquicamata which belonged to the Calama company have produced much copper. The smeltery at Calama is a poor thing and, with the exception of a few good machines, will undoubtedly be scrapped. In the stone age of this company some benighted manager was offered a lead water jacket and it was such a bargain that he bought it for his copper ores. It is there yet. During the Triassic they tried a leaching process and had lots of excitement and sent many telegrams to Santiago and Valparaiso about the results. At a more recent period concentration was attempted because a second-hand ball mill was offered cheap. As there was no old classifier about, classification was not attempted. Later, another attempt at concentration was made, and correspondence at the mine was seen showing that the manager



GENERAL VIEW OF THE CALAMA SMELTERY

ordered an Isbell vanner and thought he was ordering an Isbell table.

During the time that options were being obtained on the Chuquicamata property, the Calama company stockholders hugged the idea that "the yankees must have our property," and this has kept the price too high until lately. However, these same stockholders were wise enough to play the Ore Trading Co. against the Chile Exploration Co., which resulted in the price being about a million pesos higher than it would otherwise have been.

The whole plant at the smeltery, except the engines, is out of doors, as it never rains. Note in the illustration that even the ball mill is not covered, and the ore was fed by hand and foot, with the assistance of a ladder. The yankees have now taken hold of the property, and we Chileans know that they will make a dividend-payer of it—even if it does taken eight times as much money as they estimate.

**The Papuan Mines Options Syndicate** will increase its capital, according to the "Australian Statesman and Mining Standard," from £800 in £10 shares to £1,300, by the issue of an additional 50 shares of £10 each. The syndicate has an option over two leases, stated to be on the line of lode on which the B. H. Proprietary Block 10 Co.'s Misima lease is situated. The option is open until after Jan. 15, 1917.

# Railway Geological Department

By Joel H. Watkins*

*SYNOPSIS—No business organization realizes more clearly than a railroad company that "preparedness" means internal organization of commercial affairs as well as preparation for national defense. In the new order of affairs, the economic geologist is to play an important part in the adjustment of business to natural resources within the territory served by a railroad.*

In recent years some of the railroads of this country have enlarged the scope of their industrial departments by adding to the staff of this branch of the service one or more economic geologists. In some instances the positions have been made permanent, requiring the whole time of the geologist, while in other cases the geologist is retained in a consulting capacity and called in only on special problems. As this is rather a new departure for railroads, it is natural that much interest has been created, and we often hear the question asked, "Why does your railroad maintain a geologist?" or "What possible use could a geologist be to a railroad?" As economic geologist for the Southern Railway Co. for nearly six years, I feel that I now have a somewhat better idea of the value of a geologist to a railroad company than I had six years ago. In response to a request from the editor of *Engineering and Mining Journal* for a discussion of this new field for the geologist, I will therefore outline briefly some of the possibilities of this work as I see them at this time.

The primary object of the Federal and various state geological surveys is to intelligently facilitate the exploration and development of the mineral resources of the country, both as a source of employment and wealth for the people and as a source of materials and revenues for the nation. Why, then, should not an economic survey of the mineral and chemical resources of territory served by a railroad be of incalculable value as an ultimate source of freight revenue?

## The Function of the Geologist

Geology, chemistry and physics are so correlated and so dependent, one upon the other, that a technical knowledge of one is incomplete without a working knowledge of the other two. Economic geology has to do only with the occurrence and study of minerals and mineral substances that are of economic value. Industrial research, in the terms of Gore, is "the art of scientific discovery" in the field of industrial arts. An industrial-research laboratory in connection with a department of economic geology would be a most efficient combination in facilitating the development of both chemical and mineral industries. I know of no field wherein an institute of this kind could have a broader and more useful service than in promoting the development of the mineral and chemical resources tributary to a great railway system.

All productive industries are absolutely dependent upon original raw materials, either organic or inorganic. These materials must be transported from the position of their origin and assembled before they can be converted by the processes of manufacture into materials of useful form. It is only an intelligent knowledge of these materials and of their usefulness that will ultimately bring about their exploitation and development.

In the natural course of events many mining and chemical industries will originate along a railroad without any particular effort on the part of the railroad's employees to secure such enterprises. Other developments are brought about through the direct efforts of the railroad's employees. Were there only one railroad in a given territory, it could by no means afford to wait for the development of its latent resources through the casual activity of people who have no particular interest in the welfare of the company. But that is not the case—there are a number of good railroads in this country, traversing the same states and serving much of the same territory. Developments which, by virtue of the progress of the times, are destined sooner or later to reach a given territory must be located on some railroad. There should be much keen competition between railroads for the establishment of such permanent freight producers along their lines. Those roads which pursue a broad and liberal policy in anticipating and fostering such new enterprises are sure to grow more rapidly and more substantially. So there are more reasons than one why a railroad should take an active part in promoting the development of its own potentialities.

The tendency in mining today seems to be toward the exploitation of large bodies of low-grade ore operated on an extensive scale, rather than toward the mining of small bodies of high-grade ore which give rich returns but are short-lived. The six great porphyry mines best illustrate this idea. The effect of such enterprises upon the freight revenues of the railroads serving them is obvious. A glance at the classified tonnage of several railroads in different parts of the country for 1915, given in Table 1, will show that the stability of the railroads is largely dependent upon a volume of low-grade freight; the unmanufactured products of the mines and forests being among the lowest rate classifications.

TABLE 1. CLASSIFIED REVENUE FREIGHT TONNAGE FOR 1915

| Railroad | Products of Agriculture, Tonnage % | Products of Animals, Tonnage % | Products of Mines, Tonnage % | Products of Forests, Tonnage % | Manufactures, Tonnage % |
|---|---|---|---|---|---|
| Southern | 13.82 | 1.16 | 40.30 | 15.52 | 16.39 |
| Norfolk & Western | 4.18 | 0.69 | 79.13 | 5.58 | 9.52 |
| Baltimore & Ohio | 6.51 | 1.37 | 64.09 | 3.87 | 16.92 |
| Pennsylvania | 5.11 | 1.55 | 60.16 | 3.89 | 14.29 |
| Santa Fe | 26.57 | 5.74 | 38.65 | 7.31 | 14.60 |
| Southern Pacific | 21.78 | 3.02 | 37.35 | 15.80 | 14.24 |

## Railway Geological Field Work

The value of a geologist to a railroad company must be based largely upon his comprehensive knowledge of all minerals, building stones and clays tributary to its lines. An accurate and unrestricted knowledge of the economic occurrence of such mineral substances cannot be acquired by reading theories and reports prepared by others. First-hand information, which can be obtained only by hard and diligent field work, is an absolute necessity. The man with trained eye and brain, who has seen the materials as they occur in nature, not only in one place, but in many places, has a great advantage over the man who sits in his office, reads a report and wonders if the material

*Geologist, Southern Railway Co., Washington, D. C.

is really there. In these days of modern railroading the word efficiency is a term familiar to all branches of the service. If efficiency or even fair results are to be expected of a geologist maintained by a railroad, he must have both the moral and financial support of his employers. That is to say, he should be given every facility for carrying forward this important work in a broad and systematic way. He should be given a staff of competent assistants with ample space and a well-equipped physical, chemical and clay-testing laboratory. He cannot know too much about the materials with which he is working.

If a prospective client were to call upon some railroad official for advice in regard to the occurrence of some particular materials upon which a permanent industry was dependent, he would be disappointed if he were handed an out-of-date report and told that the company had no first-hand information in regard to the materials. His patronage would probably be lost. If, on the other hand, he could be taken to the company's industrial-research laboratories, shown samples and analyses of the materials he desired, maps, cross-sections and photographs of the occurrence, if the industrial engineer in charge could intelligently compare these materials with similar materials from other localities, if he could discuss uses, market conditions and cost of production, his advice would be of value and he would gain the confidence of his client. Field work, then, which gives an unrestricted first-hand knowledge of the occurrence of materials with which it is desired to work, is a most important part of an efficiency plan.

### Industrial Usefulness of Materials

Next in importance to a knowledge of the occurrence of materials is a working knowledge of the usefulness of materials. That is to say, one should know the course of the raw materials from the mine to the factory. Each manufacturer's requirements should be known, also for what purpose each particular substance is best suited. Information of this kind is not vested in any one person by virtue of the position he holds, nor can it be acquired by reading press reports. It must be diligently sought after and carefully correlated and compiled. Efficient knowledge as regards the usefulness of materials requires investigations in the factory instead of in the field. Industrial plants must be visited and talk had with the chemist and the manager. As many pertinent questions must be asked as they are inclined to answer, samples taken of their materials and literature, and then a visit made to competitors. The viewpoint of the manufacturer can thus be learned, enabling the geologist to better help him solve his problems of economic production.

Some years ago, while with the Pennsylvania Railroad, I remember being struck with the importance which railroad officials attached to initiative. While discussing the qualifications of a young man who was in line for promotion, they would say for example, "He is a good engineer and knows his subject, but unfortunately he lacks initiative"; which is to say, he lacked the progressive application of his knowledge.

Assuming that the geologist's knowledge of the occurrence and usefulness of the material resources with which he is working is fairly intelligent, he can hardly afford to rest upon his laurels and wait for clients to find him out. In fact, his store of information, however complete, would be of little value if he were not in position to place it in the hands of the most responsible people. It is one thing to produce an article and another thing to sell it. He must anticipate the needs of clients and must take the initiative in placing at their disposal the confidential data which he feels they can use. Almost all railroads advertise extensively their golden industrial opportunities. It is probably a fact that if a large mineral or chemical industry were projected for a given territory, its engineers would not come to the railroad for guidance. The reason for this is that experience has taught the public that in most cases the information furnished by railroads is of such a general character as to be of little value. It is also a very hard matter to approach a manufacturer with a proposition that he has never thought of before and secure his interest. There is another and, to my mind, an infinitely better way to bring to the attention of clients the proposition desired to have them consider. The geologist's work should be of such a high standard and his personal acquaintance among engineers and chemists should be so intimate and extensive that his confidential advice would be always solicited. Geologists, mining engineers, chemical engineers and ceramic engineers represent a group of scientific men upon whose shoulders rests the responsibility of many industrial developments. More and more each year capitalists are relying upon the judgment of such trained men to insure the success of their enterprises. In order that the geologist may enjoy the privilege of a confidential acquaintanceship with such men, he must join their societies, read their literature, attend their meetings and prepare articles for their magazines. Each industrial engineer added to his list of acquaintances is a new prospect, for sooner or later one may have some economic problem with which to approach him for advice. He must make their interests his interests if he hopes to secure the coöperation so necessary in anticipating new developments. Too much emphasis cannot be laid on the importance of having a working knowledge of the fundamental requirements of the manufacturer, a wide acquaintance among research men, and a far-sighted anticipation of the progress and trend of industrial arts.

### Railroads' Part in Industrial Preparedness

Probably the most vital question before the country today is the problem of organized military preparedness. The word preparedness has become a slogan in the mind of every progressive American citizen. We are beginning to realize that preparedness is equally as important to internal commercial affairs as it is to national defense. No organization appreciates this more forcibly than a railroad company. All that has been said, if sifted down, will resolve itself into the word preparedness. Anticipation, exploration, investigation, organization and conservation all insure preparedness. The geologist must be prepared to give intelligent information when the opportunity presents itself; and more than that, he must often make the opportunity.

The immediate possibilities of chemical and industrial research in this country are so great that it is useless to venture an expression as to the progress that will be made. A few of the outstanding specialties now largely under control of the research chemist which have come under observation are as follows: Clay-working materials, limestone products, coal-tar products, fertilizers, paints, refractory materials for bricks, crucibles, etc. Of equal importance, perhaps, are building stones and marbles,

abrasive materials, barium compounds, cement and glass materials, graphite, slate and other roofing materials.

There is no class of industries in this country growing more rapidly and more substantially than the clay-working industries. The final test for any clay product is made in the burning. In order to give intelligent advice in regard to kaolins, shales or common clays, the geologist must first make preliminary tests of these materials in his own clay-testing laboratory. He can then go to a manufacturer with a definite proposition and convince him.

The first question that always arises in regard to coal is the question of analysis, whether it is to be consumed as fuel or in the manufacture of coke or coal-tar products. Where there are several coals to choose from, analysis is always the controlling factor. A railway geologist should have at his command a complete list of all producing coal mines along his railroad, with a number of reliable analyses of the coals from each mine, to enable intelligent comparison and show the character of the coals from which to select.

### Importance of Electrical Power at Low Cost

Electrochemical and electrometallurgical industries are rapidly becoming of far-reaching importance in this country. Probably cheap electric power is the most essential thing to the success of such industries. It would be useful to have accurate detailed information on all developed and undeveloped water powers in the territory served by the railroad as well as the comparative cost of power developed with steam at the coal mine and at other points. There are many instances where hydro-electric power, of from 500 to 3,000 hp., can be developed at a very low cost, but on account of the distance from the points where it can be disposed of, the loss in transmission is too great. Such powers can often be utilized to great advantage where raw materials used in electrometallurgical and electrochemical industries are close at hand. A finished product can be produced at a minimum cost and will therefore stand transportation to greater distances.

Materials for the control and handling of high temperatures, which come under the head of refractories, have reached an output of great magnitude in recent years. This class of industries owes its progress largely to a new type of specialist now known as the engineer of refractories. Among the more important materials consumed in the manufacture of refractories are fireclay, flint clay, quartz, magnesite, asbestos, graphite and bauxite.

Under the head of abrasive materials is a long list of natural and artificial substances of varying degrees of hardness used in grinding, finishing and polishing metals, enamels, stone, glass, wood, leather and other products. Natural abrasives include emery, corundum, silica, garnet, feldspar, pumice, etc. Artificial abrasives are generally produced in the electric furnace. The properties of abrasives, including hardness, sharpness and fineness of particles, are generally determined by actual physical tests. Many new and useful materials of this class may be brought to light in the laboratory.

Lack of space prohibits the mention of other materials that might be studied profitably in the field and in the research laboratory. Such a branch of the service, however, would give the railroads a powerful control of industrial developments and would enable them to conserve their natural resources, a step extremely desirable in view of present conditions.

## The Canadian Nickel Industry

In the first half of the present year the production of nickel in Ontario was 42% greater than for the corresponding period of last year, according to the report of the Ontario Bureau of Mines, an abstract of which was published in the *Toronto Globe,* Nov. 7, 1916. It is probable that the output will be greater, and the value also, during the latter half of the year. Early in the new year the smelting and refining capacity served by Ontario ore will be larger, as additions are being made to that in the United States and Britain and new plants are in course of erection in Canada. More information has recently been forthcoming with regard to the development by the British-America Nickel Corporation, which received from the British government an undertaking to accept part of its output, and in addition the bonds of the company will be guaranteed by that government. This is undoubtedly part of a plan to increase the supply of nickel for the government without dependence upon anything in foreign countries, but the exact details will not be known until the government announces them.

Not long ago it was given out that the new refinery of the International Nickel Co., at Welland, Ont., would be turning out refined metal within 12 months, and at the same time an announcement was made that within a few days actual operations on the building of another refinery for the British-America Co. would begin.

The value of the nickel produced in Canada since 1889 is shown in the accompanying table.

CANADIAN NICKEL PRODUCTION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1889.. | $498,286 | 1896.. | $1,188,990 | 1903.. | $5,002,204 | 1910.. | $11,181,310 |
| 1890.. | 933,232 | 1897.. | 1,399,176 | 1904.. | 4,219,153 | 1911.. | 10,229,623 |
| 1891.. | 2,775,976 | 1898.. | 1,820,838 | 1905.. | 7,550,526 | 1912.. | 13,452,463 |
| 1892.. | 1,399,956 | 1899.. | 2,067,840 | 1906.. | 8,948,834 | 1913.. | 14,903,032 |
| 1893.. | 2,071,151 | 1900.. | 3,327,707 | 1907.. | 9,535,407 | 1914.. | 13,655,381 |
| 1894.. | 1,870,958 | 1901.. | 4,594,523 | 1908.. | 8,231,538 | 1915.. | 20,423,348 |
| 1895.. | 1,360,984 | 1902.. | 5,025,903 | 1909.. | 9,461,877 | 1916.. | *23,000,000 |

* Estimated.

The work of the British-America Co. will be undoubtedly of great importance and will be directed by E. P. Mathewson, one of the leading metallurgists of the continent, who has just left the Anaconda Copper Mining Co. to associate himself with this new undertaking.

The first and largest producer of nickel in the world is the International Nickel Co., which does its refining in New Jersey, but smelts matte at Sudbury, through the Canadian Copper Co., which it controls. Another corporation is the Mond Nickel Co., of Great Britain, the head of which is Sir Alfred Mond. This company also smelts its ore into matte at Coniston, Ont., and the matte is refined at Clydach, Wales, those works being greatly enlarged in 1914. The International Nickel Co. takes practically all of the 59,000,000 lb. shipped to the United States and the Mond company all of the 12,000,000 lb. that goes to Great Britain. Each of these corporations works by its own processes, which have been evolved after much experimenting and heavy outlays.

A third corporation was organized in July, 1913, under the name of the Canadian Nickel Corporation, but in the following month the name was changed to the British-America Nickel Corporation, and its plans are now taking more definite shape. The old Murray mine has been further worked, and recent developments indicate quality and extent of ore much better than anticipated. The company bought up the nickel interests of the late John R. Booth and others and now controls 17,000 acres of Sudbury land and has obtained the Canadian rights

to the Hybinette process. It is claimed that with this process nickel can be produced 99% pure. The nominal capital of all the Canadian nickel companies is about $100,000,000. The capital of the International Nickel Co. is $62,000,000, but of this only $2,500,000 is in the Canadian Copper Co. The Mond Nickel Co.'s capital is £850,000, represented mostly in Great Britain. The nominal capital of the British-America Nickel Corporation is $30,000,000, but present developments may shortly result in changes in this organization's finances.

## Melting Aluminum Chips

A bulletin recently published by the United States Bureau of Mines gives an account of experiments made to compare the recovery of metallic aluminum in melting down chips such as are obtained in the automobile factories in machining aluminum castings. As aluminum has sold at three times its normal price for the past year, and as a recovery of but 60% of the metal in the chips is common, and a 90% recovery is commercially possible, the preventable loss is of considerable magnitude.

The bulletin discusses the causes of the high loss in the usual method of melting chips and shows that the difficulty of getting the tiny globules of molten metal resulting from the fusion of the very fine chips to coalesce, when covered with a skin of oxide and dirt, is apparently the main cause for low recoveries. Two methods of melting can be successfully used to promote coalescence. In one the chips are kept just above the fusion point and the globules made to coalesce by hand puddling, which breaks through the skin and makes the globules unite. In this method melting is best done in an iron pot heated by an oil-fired burner.

The other is by the use of a flux which melts off the skin of dirt and oxide, producing clean globules which can unite. The flux suggested is 85% common salt, 15% fluorspar, used in large amount (20 to 30% of the weight of the chips) and mixed with the chips before charging. Much higher temperatures are required by this method than by the puddling method, so the iron-pot furnace is not practicable, and melting is best done in graphite crucibles or in a reverberatory furnace. The flux method does not require the constant hand puddling of the other method.

Since the presence of dirt and oxide causes low recoveries, the necessity for care and cleanliness in the collection and storage of chips is emphasized. Chips wet with cutting compound will oxidize superficially on storage, but by drying the chips by centrifuging this can be prevented. Perfectly clean chips can be melted without much loss by either method, while very dirty chips cannot be handled at all so as to give the high recoveries of clean chips, although the two methods mentioned gave better results on dirty chips than any others tried. Care and cleanliness in the collection of chips in the machine shop producing them will give chips from which a high percentage of metal can be recovered.

**Inspection Trip of Spanish Engineers,** as noted in "Revista Minera," has for its object the study of progress at the principal centers of the iron and steel, shipbuilding and electrical industries of the United States. The party, consisting of various experts, engineers and managers of establishments in the Province of Vizcuya, recently sailed for New York. Among them are Don Mariano Zubiria and Don Remigio de Eguren and the mining engineers, Don Juan Urrutia y Zulueta and Don Manuel Ocharan.

## Foreign Trade in Lead and Zinc

Imports of lead and zinc during September, 1916, are reported by the Department of Commerce as follows:

| Articles and Countries | Contents, Lb. |
|---|---|
| **Lead ore:** | |
| Canada | 204,200 |
| Mexico | 2,516,372 |
| Peru | 84,891 |
| Salvador | 264 |
| Chile | 1,289,920 |
| | 4,095,647 |
| **Lead in base bullion and bullion:** | |
| Guatemala | 30,400 |
| Mexico | 505,732 |
| Peru | 7,533 |
| | 543,665 |
| **Lead, pigs, bars and old:** | |
| England | 800 |
| Mexico | 1,778,353 |
| Barbados | 2,423 |
| Other British West Indies | 283 |
| Danish West Indies | 1,579 |
| | 1,783,438 |

The actual tonnage of lead ore imported in September was 11,016.

The imports of zinc ore amounted to 14,950 tons in September. The countries of origin and the metal contents were as follows:

| Countries | Contents, Lb. |
|---|---|
| Canada | 849,050 |
| Salvador | 7,677 |
| Mexico | 7,551,560 |
| China | 15,433 |
| Australia | 1,495,550 |
| | 9,919,070 |

Zinc in blocks, pigs, etc., was imported as follows (in pounds):

| | |
|---|---|
| Canada | 1,155 |
| Costa Rica | 1,102 |
| Mexico | 6,613 |
| Cuba | 21,992 |
| | 30,862 |

Imports of zinc dust in September amounted to 95,543 lb. from Japan.

Exports of lead and zinc during September were as follows (in pounds):

| | |
|---|---|
| **Lead, pig, bars, etc:** | |
| Produced from domestic ore | 31,266,557 |
| Produced from foreign ore | 1,444,000 |
| **Zinc, pigs, bars, etc.:** | |
| Produced from domestic ore | 32,894,269 |
| Produced from foreign ore | 1,930,000 |
| Zinc plates and sheets | 5,616,366 |

## Injury to an Employee at Ore Crusher

By A. L. H. Street*

In upholding a judgment denying the liability of an ore company for fatal injury to an employee while at work at an ore crusher, the Utah Supreme Court holds in the case of Virend vs. Utah Ore-Sampling Co., 160 Pacific Reporter, 115, that decedent must be deemed to have assumed all risks of injury naturally incidental to his work, so far as those dangers were obvious to one of his experience; and that no judgment could be awarded against the employer on account of the accident in the absence of proof as to the cause thereof, if the cause was left as a matter of conjecture as between conditions for which the employed would be liable and conditions for which he would not be legally responsible.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

# Manganese Ores of Bukowina*

*SYNOPSIS—The manganese deposits of Bukowina are not such as to be susceptible of profitable exploitation in normal times and with low-priced mineral. In the event of high prices and necessity, however, such as exist at the present, these deposits may be of great value. The ores are mined, milled and concentrated according to standard practice, the costs of operation indicating the probabilities for profits.*

Toward the close of the year preceding the outbreak of the war some time was spent in the Bukowina, Austria, visiting the manganese-ore deposits of the Dorna Vatra district, and in view of the importance of knowledge of these supplies, a description of them will be of interest.

Before the war broke out, the world's annual consumption of 50% manganese ore was 2 to 2½ million tons, practically all of which was produced in the Caucasus, India and Brazil, in the proportion of five, four and one. The closing of the Dardanelles stopped shipments of Caucasian ore, leaving the output of India and Brazil at the disposal of the Allies and the United States; the production of India going principally to the Allies, while the mineral from South America was taken mostly by the United States. For 1912-13 Germany used 514,000 and 680,000 tons of manganese ore respectively, coming from Russia, India, Brazil and Spain. In 1912 Germany produced 17,000,000 tons, and in 1913 18,000,000 tons of steel. At the present time her output of steel is estimated at about 15,000,000 tons per annum. A part of the manganese-ore imports, probably 25% of the total, was used for the production of ferromanganese for export.

In 1911 Austria imported 78,790 tons of manganese ore, of which 52,143 tons came from Russia. This empire will probably be producing steel now at the same rate as in 1911, say about 2½ million tons per annum. The blockade of the Central Powers and the cutting of railway communication between Russia and Austria now prevent the importation of manganese ore suitable for ferromanganese production from the usual sources of supply.

## German and Austrian Manganese Production

Before the high-grade ores from Russia, India and Brazil were placed on the market, a number of manganese-ore deposits were worked in Germany, but during recent years they could not, by reason of their pockety character, compete in price with the imported ores, and at the time the war broke out their production was negligible. There are, however, a number of manganiferous iron-ore deposits in Germany, the mineral from which is largely used for the manufacture of spiegeleisen. During 1911 the total production of these deposits amounted to more than 3 million tons, containing up to 20% of manganese, of which, however, only 300,000 tons had contents of 20% and over, the greater part giving from 2 to 12% of manganese.

As in Germany, and probably for the same reason, the production of manganese ores in Austria-Hungary never appears to have been on a large scale. From several publications a few particulars of manganese-ore occurrences in that empire have been found, other than those of the Dorna Vatra district. These include Carnioles at Vigunsica, Bohemia at Platten, Istria at Kroglje, Styria at Kaskogerl, Hungary at Felso-Visso, and in Bosnia at Cevljanovio and Derazevic, near Serajevo. The average annual output of manganese ore for 1909-13 was: Austria, 15,465 tons; Bosnia and Herzegovina, 4,450 tons: Hungary, 13,737 tons.

## Situation of the Deposits

The manganese orebodies are situated on the slopes of the Carpathian Mountains in the neighborhood of the town of Dorna Vatra, a watering place near the frontier between Bukowina and Roumania. The principal deposit, that of Arschitza, is 3 km. to the southeast of the village of Jacobeni, and the others, of less importance, known as Orata, Oitza, Kilibaba, Putchos and Valaputna, occur to the north of Jacobeni; while those of Teresia, Rosch and Sara Dorna lie in a southerly direction, near the Roumanian frontier. The district is wooded and mountainous, varying in altitude between 800 m. and 1,300 m. The roads are good, and railway communication is maintained to the Austrian steel works by a standard-gage line running from Dorna Vatra to Hatna, where it joins the main line between Lemberg, Czernowitz and Bucharest. The climate is good in summer, but rigorous during the winter, which extends from December to early May.

## Geology and Occurrence of the Ore

Information regarding the geology of South Bukowina was first published by A. Alth, in an article in von Leonard's "Jahrbuch für Mineralogie," in 1848, while later, F. Herbig wrote a treatise on the minerals of the state, which was printed at Czernowitz in 1854. In that year B. Cotta visited the district with Manz, and afterward wrote a paper on the ore deposits of South Bukowina. In 1876 B. Walter wrote on the same subject in the "Jahrbuch der K.K. Geologischen Reichsanstalt," and about the same time C. M. Paul prepared a geological map of Bukowina.

The manganese and iron ore are shown on the geological map of Paul as extending over a length of 30 km. along the sides of the Bistritz Valley, in a southeasterly direction from Kirlibaba to Sara Dorna on the Roumanian frontier. The most important strata in the district were crystalline metamorphic rocks, which included hornblende schists and were denominated upper mica schists, to distinguish them from the lower mica schists to the northeast, which included quartzite and chlorite members. To the west were narrow exposures of Lower Trias and Carboniferous age.

In the upper mica schists a band of great thickness of a siliceous schistose rock occurred, which in places outcropped on the flanks of the mountains and elsewhere cut across them. The siliceous schist inclosed, in many places, lenticular bodies varying in size up to a maximum of 100 m. in length and 40 m. in width, containing oxides of manganese and iron, which had attained a greatest development on the slopes of the mountains where the rock had been most exposed to the action of organic agencies, and was not far removed from the mica schist foot

*Excerpt from an article by Herbert K. Scott, presented at the annual meeting of the Iron and Steel Institute, London, September, 1916.

wall which, from its impervious character, had kept the meteoric waters in the siliceous schist.

In the center of the manganiferous zone and 3 km. from Jacobeni were the principal deposits of Arschitza and Argestru. At these places three principal lenses of ore had been developed, which had a northwest strike and at the surface appeared to be closely associated, but in depth became thinner and spread out in fan shape. The middle lens had an inclination of 30°, while the others dipped from 40° to 50°. On the west side of the Argestru Valley, evidence of a fourth lens was visible, which showed mica schists at both the foot and the hanging wall.

### The Arschitza Deposits

At the Teresia quarry, to the southeast of Dorna Vatra, a large lenticular mass of ore, which at the surface was 150 m. in length and 30 m. in thickness, had been quarried. The dip of the orebody was about 20° in its strike southeast. It rested on the mica schist at Arschitza. At Rosch, Sara Dorna and Valaputna, deposits of a similar character occurred and were examined, but in each case the work carried out was limited in extent, and little information regarding their geological characteristics was available.

At Arschitza, a large quarry had been made at the summit of a hill and iron and manganese ore were being excavated—the first, it was said, to supply the blast furnace at Jacobeni, and the second for export. It follows, therefore, that only the most siliceous parts of the orebody were visible at the surface, but it was possible to see the segregated masses and small lenses of manganese and iron ores in the open working.

With regard to these deposits Beck, quoting Cotta and Walter, says:

> The Arschitza deposit is 40 m. thick, being inclosed in mica schists that are either horizontal or dip northeast at 30°. Directly beneath is a bed of siliceous schist 6 to 20 m. thick, lying upon a hornblende-mica schist. Above the ore is a much-decomposed brownish-yellow hornblende schist. The ore deposit consists of a mixture of pyrolusite, some hausmannite, brown hematite and quartz. This mass shows distinct bedding even when decomposed, and in places its primary composition is disclosed, especially at another mine, the Oitza, near the Transylvania boundary. The deposit is in such cases seen to be built up of beds from 0.1 to 2 m. thick of manganese silicate of grayish-green to flesh color and with interspersed portions of rose colored manganese spar and quartz and layers of a yellowish-green mica-hornblende schist. The transformation of the rhodonite into the more highly oxidized manganese ores and into quartz is traceable step by step through every gradation, the alteration starting along cracks and fissures. The hornblende schist when decomposed provides the intermingled brown hematite.

By reason of the irregular occurrence of the merchantable mineral in the orebody and the large amount of low-grade ore, it had been found in practice that an average of 50% of the poor mineral was left in pillars in the stopes, while of the remainder, half was packed in the stopes, leaving only 25% of the total orebody available for the dressing plant. The specific weight of first-quality washed ore was found to be 4.20, while that of the manganese waste was 2.81.

Deducting the consumption of the deposits necessary to produce 200,000 tons of mineral already excavated and assuming only 25% of that remaining as merchantable ore, calculations showed that over 150,000 tons of mineral could be mined from the lenses above No. 1 level, a quantity which would guarantee an output of 50,000 tons per annum for three years, while further quantities both of the oxide and carbonate ore would no doubt be proved at lower levels.

As with most mineral deposits, the exploitation of the Arschitza and Teresia properties began by open working. The irregular dissemination of the merchantable ore in the siliceous schist made it necessary, however, to remove a large amount of sterile material, and consequently quarrying gave place at no great depth to mining proper at the Arschitza mine. This was carried out for some time by making narrow crosscuts from the surface to the orebody and extracting the mineral without any prearranged plan or regular filling.

Later, the form of overhand stoping in use in 1913 was introduced. Crosscuts were driven into the mountain side at vertical intervals up to 30 m., but in practice this distance was found too great, and in several places sublevels had been made to facilitate the breaking of the ore. Probably owing to the irregular shape of the orebodies, the main roads along the strike and across them to the foot wall were very sinuous, which increased the cost of mining and made transit for men and materials difficult.

The ore was extracted by making rooms to a height of 2½ m. from the crosscuts in the parts of the orebody containing merchantable ore. As the extraction progressed, these were filled with the ferruginous low-grade ore found with merchantable mineral. The timber used was spruce, with which the surrounding country was covered, and while not of great strength, it was easily obtained, straight and cheap.

When the material on the level of the drift was extracted, a rise was built through the filling and another slice of the orebody was taken out in the same manner as below. Owing to the irregular occurrence of the merchantable mineral in the orebody, good judgment was required in locating it and determining where the pillars of poor ground should be left. In some places the good mineral was so plentiful that filling was introduced from other parts of the mine. The mineral was dropped into hoppers, in the stopes, which were fitted with doors. Thence it was fed into trucks and trammed to the surface.

During the day-shift the ore was broken by hand drilling, but at night current was supplied from the central station at Jacobeni, which drove two electric percussion drills and a single-stage compressor which operated several jackhamers. The electrically operated drills were used for main roads, and the jackhamers operated in the stopes.

At the surface the mineral was discharged into piles that were picked over by girls to separate the type known as "stufen," which was sold to glass and chemical works, and a proportion of the better quality ore, which was disposed of without further treatment. The peroxide ore amounted to 1% and the raw mineral to 9% of the total output, the remaining 90% going direct to the dressing plant.

### The Mining Costs

According to the official figures provided by the management, the average cost of mining the ore for the seven years before 1913 had been 9.4 kr. per ton (about 7s. 10d.), but this figure would no doubt be reduced if the mine were operated on a larger scale. The ore was carried from the mine over light railways to the dressing plant. It was proposed to establish an aërial ropeway for this work, which would be more efficient and transport the mineral at a cost, including depreciation, of 0.8 kr. (about 8d.) per ton.

The dressing plant was about 1¼ km. north of the Jacobeni railway station and near the River Bistritz, from which it took the water for power purposes. The plant was put in operation in 1902. When constructed, it was in three sections, but only two of them were in use in 1913, the first being adapted for the small ore and the second for the lumpy material.

In the first section of the plant all the mineral was passed through chilled rolls, which fed into a double trommel with 1- and 8-mm. openings. The mineral passing through the smaller holes went directly to the settling pits, where it was accumulated as manganese mud, while the +8-mm. ore passed to the boot of an elevator, which took it to a second set of rolls before being sized with the —8-mm. stuff in five trommels of 2- to 12-mm. openings. In the second section the ore was first passed through a trommel from which the +24-mm. material went through chilled rolls and discharged into a bucket conveyor, which elevated it to a point where it joined the rest of the ore from the first trommel. This was afterward sized in four trommels, and the +18-mm. ore was trammed to the elevator of the first section of the plant, where it was passed through the second set of chilled rolls and subsequently sized at that end of the plant.

After being sized, the mineral was discharged into trolleys of 800-kg. capacity, which were carried by an electrically operated lift to the upper story, where the mineral was distributed to the pockets of the different jigs below. These were 20 in number, two of each size from 2 to 12 mm., and four each for the 15- and 18-mm. stuff. They were of the two-compartment type and gave a first and second product, and tailings that were known and sold as manganese waste.

The official returns of the plant showed an average output per day of 42 tons of washed ore, 45 tons of manganese waste, 23 tons of manganese mud and 10 tons of tailings going to the river—a total of 120 tons per day. The average of the different official analyses of the mineral produced at the mine showed in the dry ore 30.3% manganese and 0.34% phosphorus. The accompanying table shows the analysis of the plant output:

ANALYSIS OF PLANT OUTPUT

| | Washed Ore | | | | |
|---|---|---|---|---|---|
| | First Grade, % | Second Grade, % | Average % | Manganese Waste, % | Manganese Mud, % |
| Manganese. | 44.80 | 41.90 | 42.90 | 27.90 | 28.20 |
| Iron..... | 11.70 | 12.24 | 12.06 | 17.04 | 12.12 |
| Silica..... | 5.50 | 8.05 | 7.20 | 20.30 | 29.10 |
| Phosphorous..... | 0.365 | 0.430 | 0.41 | 0.534 | 0.390 |

From the particulars of the output of the plant and analyses of the different qualities of ore, it was clear that 37.5% of the total output known as manganese waste contained only 28% manganese and upward of 20% of silica, compared with the 7 or 8% in the washed ore, and was consequently sold at a low rate. A cursory examination of this material suggested the idea of subjecting it to further treatment in order, if possible, to produce a third grade of washed ore and tailings lower in manganese. The result of a test made along these lines, with material containing 25.8% manganese and 32.9% silica reduced to I. M. M. +5- and 10-mesh size, showed that while by hand separation 33% of the total weight gave 34.6% manganese and 17.9% silica, by panning the I. M. M. —20-mesh mineral, only 13.15% was separated, which gave 36.16% manganese. This unsatisfactory result was due to the slight difference in the specific weight of the constituent pieces of the waste, which varied between 2.63 and 2.99. From an examination of the accounts from 1906 to 1912 inclusive, the cost of washing the ore appeared to have averaged 1.5 kr., or 1s. 3d., per ton of run-of-mine ore.

### Cost of Ore and the Selling Price

The cost of the mineral at Jacobeni averaged 12.9 kr. (10s. 9d.) per ton. The ore was disposed of to several firms, all of which are in Moravia and Austrian Silesia. The Witkowitz Co., which, with the Kraina Industry Co., made ferromanganese for the Austrian market, purchased the washed ore and manganese waste, the former on a 46 and the latter on a 28% manganese basis, with a phosphorus penalty in both cases. The Austrian Mining and Ironworks Co. purchased the manganese mud, which it worked up at its Tryznietz plant in a rotary furnace with burnt pyrites and hot-blast stove flue dust. The Albert Hahn Co. took the selected crude ore, which was used in the manufacture of basic pig iron. The basis of sale for the mud was 28% and for the raw ore, 37% manganese with a phosphorus penalty.

Glass works and chemical works utilized the selected ore, that for the former being on a 65 and for the latter on a 70 to 75% manganese-peroxide basis. The different qualities of ore realized at Jacobeni the following prices per ton: Washed ore, 19.90 to 23.60 kr.; manganese waste, 5.50 to 5.80 kr.; manganese mud, 5 kr.; selected crude ore, 14.90 kr.; peroxide for glass works, 30 kr.; and peroxide ore for chemical works, 50 kr. The average amount per ton realized at that time was 10.9 kr., or 9s. 1d., which compared with the cost of 10s. 9d. showed a loss of 1s. 8d. per ton.

The railway rates from Jacobeni to the steel works ranged from 17.4 to 18.8 kr. (14s. 6d. to 15s. 8d.) per ton. The selling price of manganese ore in 1913 was below the average, so it is estimated that with higher prices and more energetic development of the property it could be made remunerative even in peace times. With the enhanced prices that must obtain in Austria under present conditions, the property would without doubt be very remunerative and valuable, but since the occupation of Jacobeni by the Russian troops at the end of June, this source of supply can probably no longer be considered available to the Central Powers.

## Reclaiming Zinc from Galvanized Iron

The New Jersey Chemical Co., of 145 Willow St., Trenton, N. J., is reclaiming zinc from galvanized iron scrap by a process invented by Thomas A. Shegog, the nature of which is not disclosed. A photograph of a part of the plant shows, however, that it is a hydrometallurgical process, and the statement is made that the zinc is recovered in the form of oxide.

Many years ago galvanized scrap was treated commercially by Philadelphia by J. Richards, who dissolved the zinc by dilute chlorhydric acid and crystallized zinc chloride from the solution, which was sold.

It is possible to precipitate zinc oxide from a solution of zinc chloride by means of magnesia, magnesium chloride being formed, from which magnesia may be regenerated. A process for doing this is described by Edouard Hunebelle, of Paris, France, in U. S. Patent 1,201,586. There is some interesting chemistry in this.

After precipitating the zinc and filtering off the solution of magnesium chloride, the specific gravity of the latter is not more than 30° Bé. The solution is boiled down so as to get $MgCl_2 + 6H_2O$. That salt is heated in a furnace to 165° (probably centigrade), at which temperature it is decomposed into HCl and MgO. This decomposition progresses up to 250°, when steam is injected into the mixture, which contains a large proportion of oxychloride. The temperature is then gradually raised to 550-600°. There is then evolved under the action of air and steam, which, however, must be suitably regulated, a mixture of chlorine and hydrochloric acid, which are condensed together in suitable apparatus. This chlorinated hydrochloric acid serves for dissolving a fresh lot of zinc, while the residual magnesia is used for its precipitation as oxide.

It would be interesting to have some working details of this process. To what extent, if any, is the precipitated zinc oxide contaminated by oxychloride? What are the losses of chlorhydric acid and magnesia?

## Barytes and Strontium in 1915

The report on barytes and strontium in 1915, prepared by James M. Hill, of the United States Geological Survey, is unusually complete. In addition to the usual statistics on production, etc., the methods of mining and preparation for market are described, as well as the geological and commercial features of the principal known deposits in the different states. There is also a map showing the locations of deposits of barytes and strontium ore and works manufacturing barium products. Lists are given with names and addresses of companies, firms and individuals who are able to supply crude barytes; those who manufacture ground barytes; those who manufacture lithopone (approximately 70% barium sulphate, 25 to 29% zinc sulphide and 1 to 5% zinc oxide; made by mixing hot solutions of barium sulphide and zinc sulphate); and those who manufacture various barium chemicals, such as the binoxide or peroxide ($BaO_2$, used by some manufacturers in the preparation of oxygen and of hydrogen peroxide), carbonate, chloride, hydroxide, nitrate and sulphate (artificially produced and known as "blanc-fixe" or "blanc-fix," for use as a finer pigment than ground barytes). Crude barium sulphide, or "black ash," is sold to many makers of lithophone, etc., who are not equipped to roast barytes.

The high freight rates from the Central and Southern States to the principal markets gave European barytes an advantage; but the demand in the latter part of 1914 stimulated domestic production.

The marketed output of crude barytes in 1915 is reported in short tons as: Georgia, 31,027; Kentucky, 7,753; Missouri, 39,113; Tennessee, 25,074; and other states, 5,580. For the two preceding years only the Missouri and Tennessee production was reported separately, being 33,317 and 10,113 tons respectively in 1914 and 31,131 and 2,098 tons in 1913. The total marketed production was 108,547 tons, as compared with 52,747 in 1914 and 45,298 in 1913; the average prices per ton, f.o.b. cars at points of production, were $3.51, $2.95 and $3.45, for the corresponding years. The apparent stocks of crude barytes held at the mines at the end of December, 1915, were 9,676 tons. Of these 6,500 tons were held in Tennessee, 2,500 in Georgia and the remainder scattered in small quantities in Alabama, Alaska, California, North Carolina, South Carolina and Virginia.

According to figures compiled by the Department of Commerce, 2,504 short tons of unmanufactured barytes (presumably crude ore) were imported in 1915. The imports for the years immediately preceding were, respectively, 24,423 tons, 35,840 tons, 26,186 tons and 20,214 tons. The average of the reported values is $1.85 per short ton, presumably at mines where produced.

The figures reported for apparent consumption of crude barytes are obtained by adding the marketed production and the imports. Of the marketed production, approximately 50% was used by grinders, 40% by manufacturers of lithopone and 10% by makers of barium chemicals.

## Zinc Mining Near Edwards, N. Y.

In a recent article published in *Economic Geology*, David H. Newland[1] describes a new zinc-producing district near Edwards, St. Lawrence County, N. Y. The existence of zinc ores in Edwards township has been known since the early part of the last century, some of the localities being mentioned by Ebenezer Emmons in his preliminary report on the geology of the second district of New York, published in 1838. No work of consequence was done, however, until the Northern Ore Co. started to prospect the orebody now being exploited.

Development work has been in progress for some time, but the first ore shipments on a commercial scale were made in 1915. The output thus far has been from a single mine, situated just outside of Edwards village, on the road to Trout Lake. The deposit is opened by an incline to a depth of 525 ft., the dip ranging from 25 to 60°. A series of levels, at intervals of 100 ft. or less, follow the ore to a maximum distance of about 600 ft. A second orebody on the hanging-wall side appears at the surface. At different levels this has been reached by crosscuts and drifted on to a maximum distance of 250 ft. Another shaft had been sunk on a third body 800 ft. away, but at the time of the inspection in the summer of 1915 no ore had been produced from this source.

The Edwards district is known as a producer of fibrous talc, used extensively in the paper industry. In Edwards township and in Fowler township (adjoining it on the west) are several places where talc and blende deposits occur; both lying within the same belt of crystalline limestones and in places closely associated with each other, as is the case near Sylvia Lake, south of the village of Fowler.

The zinc outcrops occur mainly along the contact of Precambrian limestones of the Grenville series and the bordering granites and schists. The prevailing shape of the orebodies is lenticular, appearing on the surface as bands or stripes of ore in the limestone and thinning out at either extremity, sometimes with a rounded outline and occasionally without any regular form.

At the main shaft of the Northern Ore Co. the ore outcrops on the eastern side of a low limestone ridge as a solid band of mixed blende and pyrite, with well-defined parallel walls. At the surface the ore is 4 ft. thick, and it increases to a maximum of 14 ft. on the 200-ft. level, below which it thins down, but still persists at the 500-ft. level. As a rule the walls are sharply defined and on one wall, at least, the ore always breaks cleanly from the limestone.

[1]Assistant state geologist, State Education Building, Albany, N. Y.

At the north shaft the deposit consists of a zone of limestone heavily charged with serpentine. It carries blende and pyrite in bunches and disseminated grains, in a gangue that is largely serpentine. The zone is irregular and in the widest parts is about 15 ft. across. Though somewhat brecciated at the surface, the deposit seems to have the form of a shoot. Some movement of the mass is indicated by slickensides. A deposit of similar nature exists at the property of the Dominion company near Sylvia Lake. It was opened years ago for iron ore, existing as a hematite cap to the sulphides found less than 100 ft. from the surface.

Most of the blende of the Edwards district is the dark variety known as "black jack." In occasional outcrops a lighter brownish-yellow variety is found, free of iron. In the darker ores pyrite always occurs and necessitates milling treatment, even where the percentage of zinc is high. The pyrite is scattered through the ores in roundish particles of uniform size, usually similar to those of the blende, and ranges from a few per cent. to one-third or one-half of the total mass. Galena occurs to the extent of a fraction of 1%, but is seldom visible in specimens; but at the north shaft a few pieces of ore showed cleavages of galena an inch or so across. On the Balmat vein near Sylvia Lake part of the ore is mixed blende, pyrite and galena, with quite as much lead as zinc. This deposit was worked in a small way about 75 years ago, presumably for the silver which the galena carries; but the ore was apparently too complex for successful treatment.

A selected specimen of zinc ore from the deposit of the Northern Ore Co. showed on analysis: $SiO_2$ 5.69%, $Al_2O_3$ 0.36%, CaO 1.45%, MgO 0.61%, BaO 1.46%, Zn 51.43%, Fe 5.80%, S 30.86%. The $CO_2$, $H_2O$, Cd and Mn were not determined, but were present in amounts of less than 1% each.

## Dynamiting a Deep Well to Increase the Flow

By G. F. Alderson*

The dynamiting of an oil or gas well is no rare occurrence, but the "shooting" of a water well near Kennett Square, Penn., was the rather unusual performance of the American Glycerin Co. a short time ago. The well, which was 600 ft. deep, started at the top of a hill with an elevation of about 460 ft. above sea level. After drilling through 84 ft. of stiff clay and hardpan, solid rock was encountered with successive strata as follows:

SUCCESSIVE STRATA OF SOLID ROCK

| | Ft. | | Ft. |
|---|---|---|---|
| Sand rock | 121.0 | Blue granite broken | 10.0 |
| Flint rock | 90.0 | Gray granite with green serpentine seams | 2.0 |
| Blue granite | 17.5 | Gray granite | 40.0 |
| White quartz | 1.2 | Blue granite | 3.0 |
| Gray granite | 47.8 | Gray granite | 72.0 |
| Blue granite | 17.5 | Bastard granite | 84.0 |
| Gray granite with quartz seams | 10.0 | Total | 516.0 |

An 8-in. steel casing was sunk to solid rock and thoroughly grouted to exclude all surface drainage, as it was especially desirous to obtain all the supply from groundwater sources. The hole through the rock was 6 in. diameter. The nature of the rock, as shown by the foregoing record, gave little indication of water-bearing qualities, although numerous crevices were encountered.

*Civil engineer, Kennett Square, Penn.

After drilling to a depth of 600 ft. the well was tested to determine its flow. This test indicated a flow of 3⅓ gal. per min., a supply entirely too small. The excessive cost of pumping equipment and upkeep made a deeper well impracticable, so it was decided to discharge a quantity of nitroglycerin in the well with the hopes that it would shatter some water-bearing stratum.

From all indications it seemed probable that the stream then supplying the well entered at about the 320-ft. level. Just below this point the well was bridged, which was accomplished by rolling a piece of stiff wire into a ball a little larger than the bore of the well, forcing this ball to the desired depth, and then introducing concrete until a solid bridge was formed just below the level at which it was desired to set off the charge. A special type of solidified nitroglycerin, which is commonly used for shooting oil wells, was used in the charge, which consisted of 190 quarts. The explosive was packed in tin tubes 5¾ in. diameter and 7 ft. long. These tubes were then placed in the well one above another, and the whole was discharged by dropping a jack squib down the well.

SHOOTING THE WELL

The illustration shows what happened. An immense column of water 500 ft. high was blown from the well. Following the shot the well was again tested. This test proved that there had been a material increase in the flow of water. The test pump working continuously for seven hours pumped in that time about 10,000 gal. After the seven hours of pumping, the water was still discharging at the same rate as when the test first started. Only the breaking of the pump rod prevented an exhaustive test to determine exactly the amount of the increase.

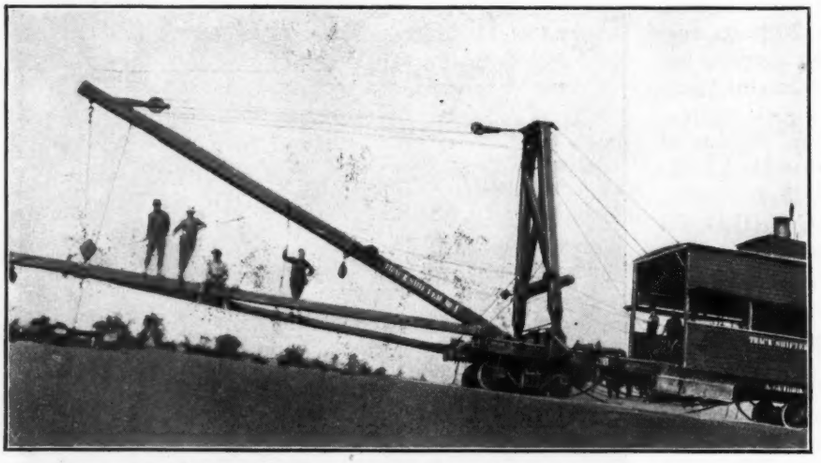
# Details of Practical Mining

## A Useful Track Shifter

By L. A. Rossman*

The largest stripping contract now in progress on the Mesabi Range is at the Hill Annex mine at Gilbert, Minn. This property is being opened up by the Great Northern Iron Ore Properties, and the overburden is being stripped on contract by A. Guthrie & Co., of St. Paul, Minn. The present contract calls for the removal of 8,500,000 cu.yd., and even this amount may be increased.

Where so much material is to be removed, the problem of dumps is a serious one. The dumps at this property now extend three or four miles in length and are of varying width. This necessitates a constant shifting of tracks to the edge of the dump. This shifting was formerly done by hand, but a machine has been devised and is now doing the work for the Guthrie company.



TRACK SHIFTER FOR STRIPPING OPERATIONS

This machine is the result of several years of experimentation, as the contractors started to work on it several years ago when engaged in railroad operations in the West. A number of types were evolved, but the present one has given the best satisfaction. The contrivance resembles a wrecker in its general appearance. There is a boom about 40 ft. in length, and a wire rope which is attached through its pulleys is fastened to the track for the purpose of lifting it up. On a level with the base of the machine is a side boom by which the track may be pulled sideways if desired. The operation is to attach the rope from both booms. The regular boom lifts to the required height, while the side boom is used to swing the track over to the desired place. There is one hoist of regular type and a horizontal boiler which furnishes the steam. The machine is self-propelled in the same manner as a steam shovel.

This device can throw a track over 6 ft. at a time, though the work must be done gradually to avoid either bending or twisting the rails. The method followed is to shift a track over 4 or 6 ft. and then move back 30 ft. and make a like move. The shifter has moved as much as 3,000 ft. of track a distance of 10 ft. in half a day, or more than forty men could do in a whole shift. While the machine requires but few men to operate, it will do as much work as 40 or 50 men and was a great labor saver during the last summer, when common labor was very hard to obtain. The apparatus has been attracting considerable attention from the mining men on the Mesabi Range, and it has a wide range of applicability.

*Grand Rapids, Minn.

## Stopes Filled by Flushed Sand*

Mine managers seeking for ideas on the economy of mine timber by stope filling may find something helpful in the following experience in India:

A river bed not far from the mine furnished a plentiful supply of clean sand, which was screened and dumped into a small bin of 20 tons' capacity sunk just below the level of the surface. The bin gate discharged the sand into an inclined trough terminating in a vertical funnel opening into a 5-in. drill-hole casing. At the upper end of the trough a 5-in. water pipe equipped with a controlling valve discharged a water jet tangentially with the trough surface, thus flushing the sand discharged from the bin gate into the drill-hole casing. A 6,400-gal. tank furnished the water supply at a head of 33 ft. When sand-flushing was first tried at this mine, the depth of works filled was 231 ft. and the horizontal distance traveled by the sand was 11,300 ft., which is believed about the maximum possible. For this distance the proportion of water to sand was about 3.3 to 1. After a fortnight's trial, long-distance working was abandoned and the horizontal distance reduced to only about 700 ft., which required a proportion of water to sand of only 1.16 to 1. The velocity of the flushing mixture was about 24.3 ft. per second, flushing away about 2.34 tons per minute.

Arrived at the workings to be filled, which at this mine are only 8 ft. high, the sand was retained in place by barricades made of rough 2-in. plank nailed to posts 2 ft. apart and covered by untarred brattice cloth. The water thus filtered through the brattice cloth and, before reaching the pump sump, was strained through two more filters of the same material, thus avoiding wear on the pump due to sand. A Worthington pump of 10,000 gal. per hour capacity was used.

The flow of sand and water into the trough was regulated by a man at the sand bin, who was in telephonic

*Abstract from "Hydraulic Storage at an Indian Colliery," by R. S. Davies, in "The Iron and Coal Trades Review," Nov. 3, 1916.

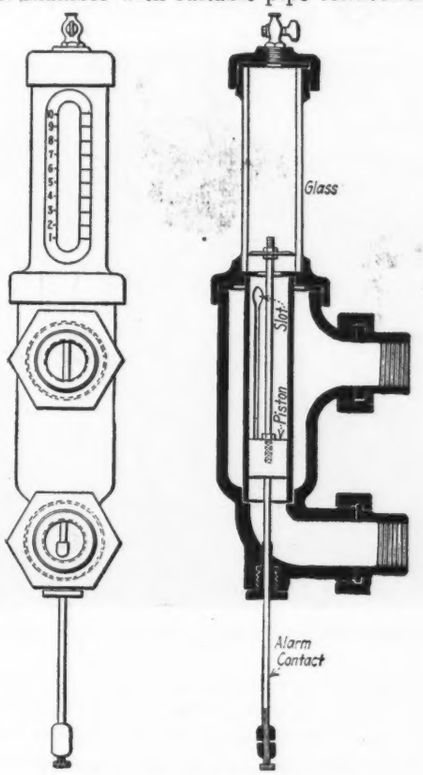
communication with the man at the working in process of being filled.

The pipes showed little wear—probably because of the screening out of all hard lumps from the sand before discharging it into the storage bin.

Owing to the low cost of labor in India—women were employed to carry the sand in baskets from the river to the bin—the total cost per ton of sand flushed was only 4½d.

## Vaughan Flow Meter

A meter designed for indicating the flow of liquids in pipes is the Vaughan, made and sold by the Spray Engineering Co., Boston. It is shown in section in the accompanying illustration. The instrument consists of a cylindrical chamber with suitable pipe connections inclos-




THE VAUGHAN FLOW METER

ing a slotted tube through which the liquid must pass.

Inclosed in the slotted tube is a piston which, as the liquid is turned on, is carried up until the exposed area of the slots is sufficient to allow the flow of the liquid up to the capacity of the indicator. An index is attached to the upper end of the piston rod, which extends up into a glass tube at the top of the cylindrical chamber. The glass tube is in a protecting cover, corresponding to the movement of the piston, to be noted. A scale on the side of the case enables the determination of the amount of flow in gallons per minute.

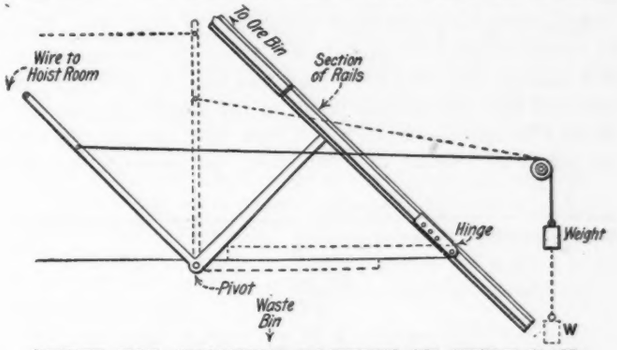
An electric contact consisting of an adjustable brass rod set through an insulated stuffing-box at the bottom of the chamber can be connected to a lamp or bell, calling attention when the flow has fallen below a fixed minimum. Contact is established where the piston rests on the brass rod. The flow is directly proportional to the area of the slots in the inclosed tube, or to the rise or fall of the piston.

Under test the indicator gives practically straight-line calibration over a large range, and the loss of head in operating the instrument has been found to be negligible, not exceeding 0.004 lb. per sq.in. with a capacity of 15 gal. per min.

## Changing Guide Rail at Head of Inclined Shaft

By L. J. Hubbard*

At the B. A. C. mine at Brownsville, Yuba County, Calif., the ore and waste are hoisted from the same compartment of an inclined shaft. The waste bin is above



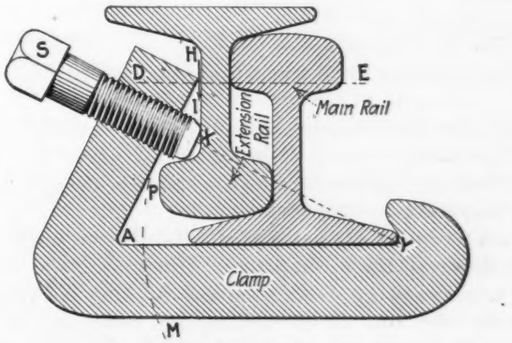

LEVER FOR CHANGING POSITION OF GUIDE RAIL

the collar of the shaft, while the ore bin is farther up. In hoisting ore and waste, this condition necessitated the hoistman removing or putting in a pair of short rails each time a change was made from ore to waste, or vice versa. This was a great inconvenience and caused considerable loss of time. The mine foreman evolved the device shown in the accompanying sketch, which has given entire satisfaction. The heavy lines show the position when hoisting to the ore bin and the dotted line the position when dumping into the waste bin.

## An Extension Rail Clamp

By S. Ford Eaton†

In incline shaft-sinking operations the type of clamp illustrated has given excellent service. The principal




A RAIL CLAMP THAT HOLDS

feature of difference from the clamp ordinarily used is the angle at *A*. Instead of being a right angle, it is such that the direction of pressure exerted by the setscrew *S* is, as

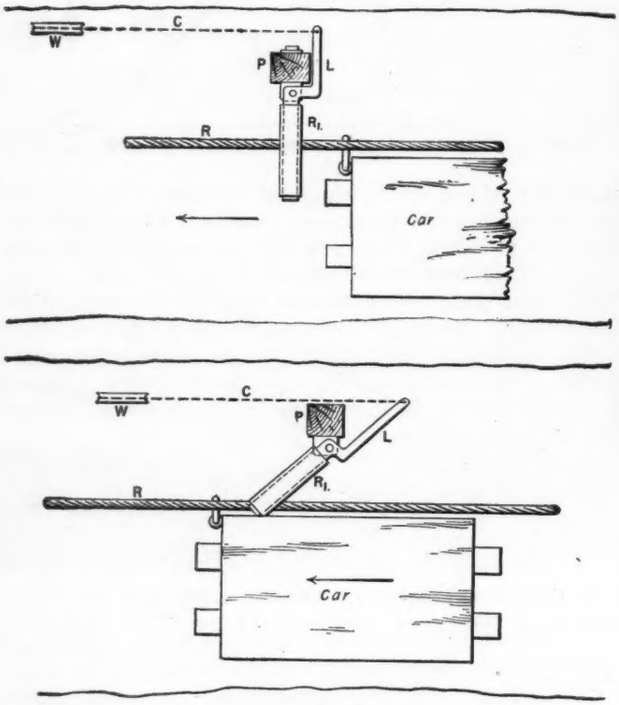
*Superintendent, B. A. C. mine, Brownsville, Yuba Co., Calif.

†Foreman, Vantrent Mining Co., Vantrent, Calif.

indicated by the dotted line *XY*, in line with the point of contact *Y* of the clamp and flange of the permanent, or main, rail. When *A* is a right angle, the line of pressure is approximately *DE*. This being the case, when the screw is tightened it has a marked tendency to slide down the web of the extension rail toward the ball (indicated by the arrow *HI*). This causes the rails to be forced out of position, and oftentimes the screw breaks. This clamp, if properly constructed, can be swung onto the rails at any point, there being ample clearance at the point *P*, as shown by the arc *PM*.

## Trouble Saver on Rope Haulage

According to an account published in *Coal Age*, Nov. 11, 1916, trouble developed on a side-rope haulage wherever a slight hollow in the road was reached, through the stress of the rope pulling it out of the jiggers on the cars. When this happened where the cars were far apart it had the effect of leaving one particular car standing on the




DEVICE TO PREVENT THE ROPE FROM RISING

track. The following one was quite liable to push it off the track, causing a wreck. Sometimes five or six cars would get piled up together before the haulagemen could find out where the trouble was.

As a means of obviating this difficulty the small appliance shown in the accompanying illustration was erected. The upper drawing shows a car approaching the appliance and the lower one the car passing and deflecting the arm.

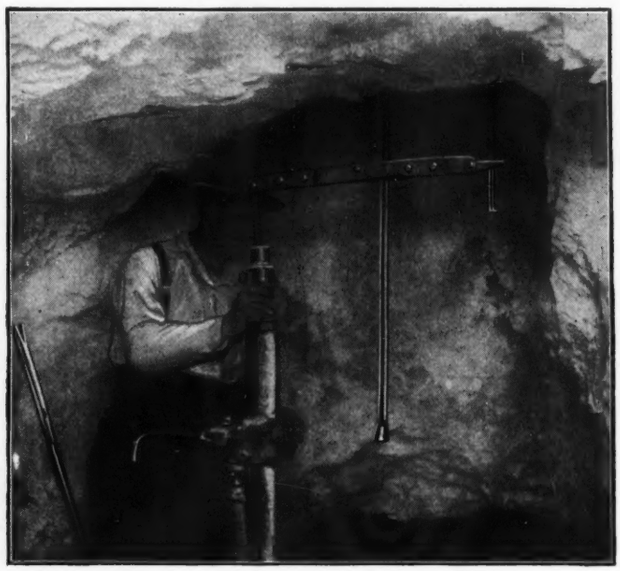
Post *P*, a strong one, has bolted to it a lever *L*, one arm of which projects behind the post, and the other in front of it and at least 6 in. beyond the line of the rope and 3 to 4 in. higher than its normal position. The front arm has a piece of pipe $R_1$ fastened to it, which serves as a roller when the rope is running up against the arm. Attached to the arm at the rear of the post is a chain *C* which passes over the wheel *W* and is attached to a counterbalancing weight.

In operation the arm $R_1$ projects over the running rope and prevents it from rising above the limit fixed. It does this without putting any perceptible stress on the working of the haulage. An approaching car pushes the arm aside, but the counterbalance exerting itself tends to draw the lever back, keeping the arm tight against the side of the car and above the rope. As soon as the car has passed the arm springs out into its original position.

## Drill-Steel Puller

By A. C. Daman*

One of the main causes of delay and trouble in drilling is the sticking of drill steel in the holes. I have seen



THE WILSON DRILL-STEEL PULLER

miners work for hours trying to remove a piece of steel and then give up. The accompanying illustration shows a successful drill-steel puller, and its simplicity makes it a handy device in mines. Two different lever arms are obtainable by means of a revolving center swivel.

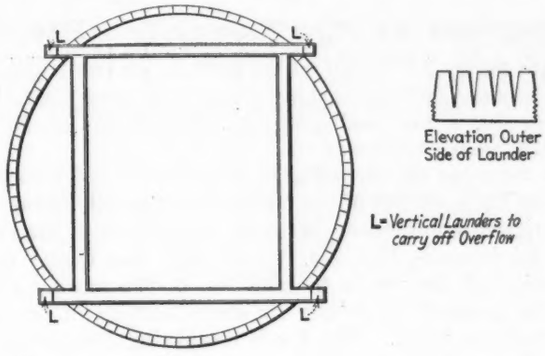
**Casehardening with Cyanide**—For many purposes a thin, hardened outer surface is required on wrought iron or steel articles. This can be quickly secured after finishing by the use of potassium cyanide. All iron and steel, roughly speaking, will absorb carbon when at a temperature of from 800 to 850° C., or, in smithy terms, from bright to cherry red. This is taken advantage of in surface hardening, the metal being heated to this point, preferably in some form of muffle, even rough. At this stage the metal can be plunged into a bath of melted cyanide or rubbed with a lump of cyanide held in a pair of tongs until the metal becomes dull red, after which reheating to the hardening temperature and immersing immediately in cold water to secure the greatest hardness possible. Properly done, this should turn a file. A better plan, where the size and shape of the articles permit, is to coat a piece of leather with powdered cyanide and press the heated articles on this, repeating the heating and pressing several times, afterward reheating and quenching. For deep casehardening the usual method of packing and heating for several hours must be adopted.—"The Practical Engineer," London.

*2678 Eudora St., Denver, Colo.

# Details of Milling and Smelting

## Altering Dorr Agitators

In a Western milling plant, three Dorr agitators were installed along with other cyaniding machinery. After the plant was put into operation, it was found that the gold went into solution so readily in the crushing department that no agitation was necessary, and further, that the settling capacity of the plant was decidedly insufficient. It was decided to change the three agitators into thickeners. This was done by extending the feed launders from the sides to the centers of the tanks, removing the revolving pulp-distributing arms, providing an outlet in the center of the bottom of each tank and adding decanting launders. The latter consisted of four straight launders in the shape of a rectangle on each tank, as shown in the illustration. This form of construction is much simpler than the usual annular launder at the top of




ARRANGEMENT OF LAUNDERS IN THICKENING TANK

the tank. A row of notches was cut along the outer side of each launder, but not to the bottom, permitting the clear liquid on top of the tank to flow through them and along the launders to the vertical discharge launders at the corners. In addition to being easier and cheaper to construct than the circular launders, the rectangular form served a direct purpose. The composition of the ore was such that an excessive amount of foam collected on top of the thickeners, the foam containing an appreciable percentage of soluble matter. The rectangular launder arrangement made a trap in which this foam was caught and from which it was skimmed at regular intervals.

## Arsenical Flue-Dust Treatment

In the application of a newly devised process the arsenical material is first sulphated, without alkaline bisulphate fusion, simply by being thoroughly mixed with sulphuric acid slightly in excess of that quantity necessarily absorbed by constituent substances with which the acid can combine. A cheapening of this stage of the process may be made by subjecting the material to the action of sulphurous gases with subsequent oxidation, thus diminishing the amount of sulphuric acid required.

The mass is then subjected to a gentle heat, with stirring, for such a length of time that when cold, it may be pulverized by rolls or other suitable means. After pulverization the material is transported to a flue or hearth, where it is maintained in a current of air or gas at an even heat above the boiling point of sulphuric acid and below the point of decomposition of the metallic sulphates.

If an air current is used, the arsenic is volatilized in combination with sulphuric acid and can be precipitated by a water spray or by electric precipitation, in a condensing chamber into which the fumes are led. This separation depends upon the fact that the sulphuric-acid compounds of arsenic are volatile at this low temperature, and owing to the neutral or acid condition of the remainder of the mass, the volatilized arsenic oxide cannot recombine with the mass. Only a small amount of arsenic will remain in the original material after this operation—usually from 0.3 to 0.6 of 1%.

The valuable metals remaining in the mass are recovered by subsequent treatment. The mass is roasted until sulphate of iron is partly decomposed, when the mass is leached with hot water, thus dissolving out the sulphates of Zn, Cd, Cu, Fe, Ag, Bi and small amounts of Sb and As, which may be precipitated and recovered by well-known means.

This process is the invention of Duncan Anderson, Jr., of San Francisco, Calif., granted U. S. Pat. No. 1,198,095 on Sept. 12, 1916.

## Copper-Refining Process

An invention designed to simplify copper-refining methods has been patented by B. A. Garred, of New York, under U. S. Pat. No. 1,198,434, of Sept. 19, 1916. For the melting furnace is substituted a coal-dust fired cupola furnace, whereby, it is claimed, the operation is placed under perfect control. For the slow method of wood poling is substituted a blast-poling process whereby the disseminated reducing agents, such as charcoal or sawdust, are made to permeate the entire mass of molten metal, thereby reducing the time of poling to a minimum.

The copper is introduced to the cupola furnace through a charge opening 12 to 15 ft. above its hearth, at which level the heaps of impure copper are always maintained. Just above the level of the molten copper on the hearth is a chambered offset to the furnace, in which combustion of the coal dust takes place, and the resulting flames impinge on the metal.

The furnace spout is situated opposite this combustion chamber, and from it the molten copper discharges into the top of a charcoal-filled tower. Thus, as the molten copper percolates to the bottom of the tower, the work of the first stage of the poling is accomplished.

From the charcoal tower the copper flows into the poling furnace. The latter is similar to the conventional converter in form, equipped with the usual pouring spout and with the ordinary hood for fume collection.

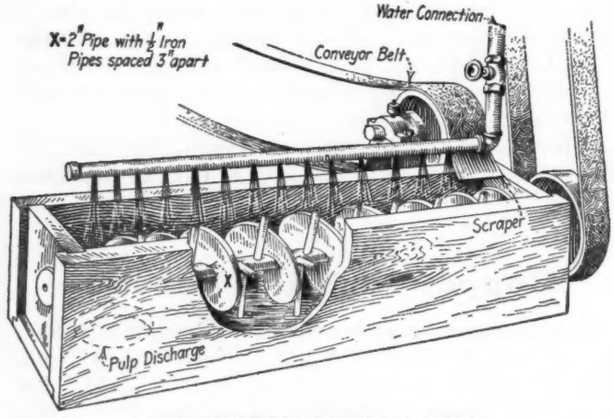
The molten copper, however, is introduced through an axial opening at one side, while the bath is maintained in a molten condition by a coal-dust blast. The blast nozzle is stationary, and its introduction into the poling furnace at any rotating position is allowed by an arc-shaped slot in one end. Instead of the air blast from tuyeres, as in the usual copper converter, the blast is maintained by a reducing gas, such as illuminating gas or hydrogen, into which gas stream fixed quantities of coal dust or sawdust are fed by a screw conveyor. In this way an intimate contact of the reducing agent with the agitated copper particles is quickly accomplished and the poling brought to an end.

The poling operation is made continuous by employing two rotary poling furnaces set close together and served by the one cupola and receiving charcoal tower. Thus, while one furnace is blowing and pouring, the other is receiving the continuous discharge from the tower and is ready to start blowing by the time its mate has finished pouring.

## A Mechanical Disintegrater

By Arthur C. Daman*

The mechanical disintegrater used at the Nevada Packard mill was designed by J. W. Wilkey. Formerly the pulp, containing about 20% moisture, was dumped on the tailings pile with sufficient water added to wash it away,




A MECHANICAL DISINEGRATOR

keeping the end of the conveyor clear. To conserve the water supply this disintegrater was made, and the pulp is mixed to a flowing consistency, with a material reduction in water needed. The spiral screw, which also has ½-in. iron pipe 10 in. long to mix the pulp and water, is revolved by the conveyor motor.

## Hydraulic Classifiers at Inspiration Mill

In the discussion upon the paper of Dr. Rudolph Gahl on flotation at the Inspiration mill, presented at the Arizona meeting of the A. I. M. E., David Cole asked why hydraulic classifiers were installed. Dr. Gahl replied, and in defense of the installation pointed out that the expense of operating these classifiers is very low, the principal cost item being labor for their attendance. In addition it requires a very small settling capacity to settle the table tailings. At the Inspiration mill it is accomplished by three 60-ft. Dorr settling tanks, with an additional tank installed for the purpose of keeping the coarsest sand out of the Dorr tanks. This small installation handles more than 7,000 tons per day. As the reclamation is accomplished right at the foot of the mill, the reclaimed water does not have to be lifted very high, and the reclaimed cost for this water is, therefore, low. In other words, the benefit derived from the installation of hydraulic classifiers does not need to be very great to make them pay.

It is true that in operating the test mill, satisfactory recoveries were obtained in spite of the fact that the whole of the flotation-machine tailings were put on the tables without preliminary classification. It was realized, however, that the table tailings (at least the coarser sizes) were not so low in their copper contents as it was hoped to have them some day. It was known, furthermore, that by grinding finer, the coarser screen sizes could be reduced in copper. As grinding finer than to a certain point is an economical impossibility, it was proposed to make different sizes and to send them to separate tables. This separation was to be accomplished in hydraulic classifiers. The coarser tailings, or perhaps only middlings from the tables, could then be reground and reconcentrated.

## Progress at Ajo Leaching Plant

With nearly 1,200 men on the payroll, the construction work on the 5,000-ton leaching plant of the New Cornelia Copper Co. is progressing rapidly. Conditions on Nov. 2, 1916, were as follows:

At the mine the stripping of the orebody and excavation for the extension of the railroad have greatly changed the original appearance. With the completion of the cut and fill between Hill No. 1 and Hill No. 2 and the extension of the tracks to Hill No. 3, the mining end will be prepared to deliver its daily tonnage of ore to the leaching plant. The track connecting the orebody with the crushing plant is rapidly nearing completion.

The building for the coarse- or primary-crushing plant has been erected; the crane for handling the crusher parts is in operation; the four No. 8 crushers are in place, while 25% of the No. 24 has been erected. The trestle and the tailings track to this building are being completed.

At the fine-crushing plant the steel building has been erected but has not yet been riveted. This is to inclose 12 Symons disk crushers; four of these have been placed, six are being set up and two are in transit.

In the leaching department seven of the 12 leaching tanks have been lined with lead, while the concrete work on all has been completed. Two of the six central structures that are to contain the pumps and launders have the concrete work finished. The electrolytic-tank house is to contain 152 electrolytic tanks; 122 are erected, of which 76 are completely lead-lined. The solution sumps, one at each of this buildings, have the concrete work completed.

The power plant, which is being built by C. C. Moore & Co., of San Francisco, is to contain five 875-hp. Stirling boilers. The boilers have all been pleced, one of them being about 50% bricked. At the town site, the tile on the first 22 American houses are in place and the work is rapidly nearing completion. Sewer pipe and water lines have been laid. About 25% of the tile on the permanent railroad station has been laid.

*Mining engineer, 2678 Eudora St., Denver, Colo.

# The Assayer and Chemist

## Laboratory Efficiency

By Byron M. Johnson*

Time-saving devices in the assay laboratory are very valuable, as there are so many processes involved that a minute saved here and there soon amounts to hours.

There are just so many steps to be performed, so the question resolves itself into: How can the time of these individual operations be cut down? In all laboratory work, there is a certain routine that always exists, and one is likely to get into the rut and remain there unless one is wide-awake and continually on the lookout for short methods and time-saving devices.

Some, and perhaps all, of the hints given here may be known to many, but let us hope that someone will find one at least that he has not heard of or used and thereby may be benefitted.

Sheets of thin wrapping paper about 9 in. square used in lieu of the small sample pan for pulps ready for mixing and weighing. They are easily handled, eliminating all chance of salting as they will not permit of stacking,

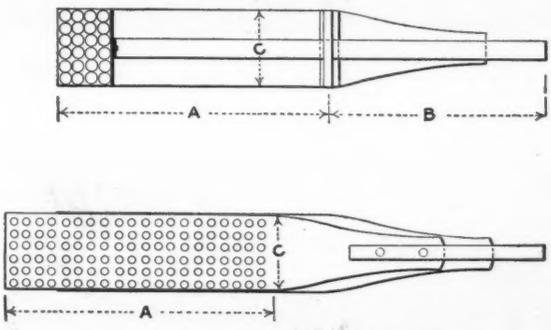



FIG. 1. LOADING TRAY FOR CUPELS

though a little more bench room may be required.

A common bar shaker consisting of a glass and an aluminum receptacle is useful for the thorough mixing of pulp. The mixing of all samples can be done at one time where papers are used instead of pans, and then the samples are ready for weighing. Mixing thus is easier than using a cloth, is more uniform and is done in about half the time. After the weighing operation has been completed, the shaker is again used in mixing the pulp and flux, instead of the spatula. Much time can be saved here also.

Loading trays for placing cupels in the muffle and buttons in the hot cupels. Figs. 1 and 2 show these. They are made of sheet iron of a thickness depending upon the furnace used; that is, ordinary cupelling muffles only will permit of a thinner metal than the hot crucible furnace.

The first tray (see Fig. 1) is so constructed that its length *A* will be the length of the muffle, its width *C* such that it will just take a row of cupels packed tightly together to avoid rearranging them when they are placed in the muffle. In this way a full muffle may be loaded in an instant and the same with the lead buttons. *B* is of arbitrary length, about 12 in. being very convenient.

Considerable care should be exercised making the second tray. First, the holes should be exactly centered, and then they should be drilled or punched from the under side and the edges allowed to project quite a little way so that the lead buttons will not be pushed out of place while loading them into the hot cupels. When the tray is loaded

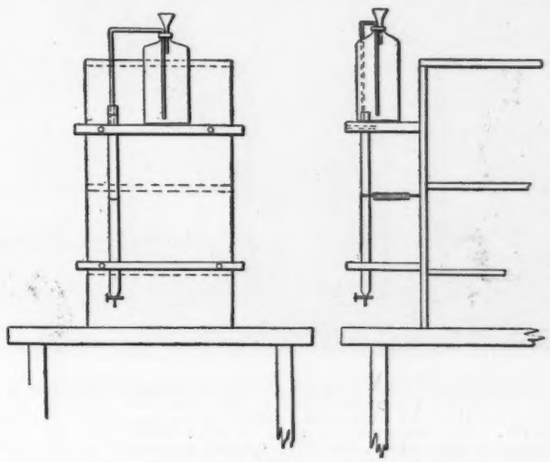


FIG. 2. A SIPHON FOR PARTING ACID

and ready for the furnace, place it carefully over the cupels in the muffle, pull out the lower plate and all of the buttons will drop into their own cupels. This is one of the best time savers that I have ever used in my laboratory, not to consider the intense heat that is thus avoided.

Referring to Fig. 2 which is a continuous siphon used in filling parting cups with acid, the sketch is sufficient to explain the apparatus. Any reservoir can be used, but as rubber tubing must be avoided, a one-way burette is the most convenient.

A sheet-metal tray for parting cups with sides at such a height that when the tray is placed on the hot plate, all the cups will rest on the plate, eliminating the necessity of their removal. Annealing may be performed in the same tray in case one desires to anneal in the furnace, though personally I prefer the use of a small hot-blast lamp as the life of the cups is much greater.

With the devices described, I have been able to save from one to two hours a day on heavy days' running, thereby cutting fuel consumption and labor costs, which are very high in this vicinity.

*Mining and metallurgical engineer, Oatman, Ariz.

**Cerium Salts May Be Purified** from other rare-earth metals by oxidizing cerous nitrate or sulphate in neutral solution with alkaline persulphates. A little silver nitrate must be added to the solution (the silver salt serving only as a catalyst), after which the reaction proceeds until all the cerous compound is changed to ceric. In neutral solution all other rare-earth metals remain in solution, while almost all of the cerium precipitates as a basic salt ("Journ. Soc. Chem. Ind.," May 31, 1916).

# Photographs from the Field

Looking up "Discovery Gulch," at the Matahambre mine, shortly after its development was started by the present operator, Manuel Luciano Diaz, of Habana. The opening of this rich copper mine in the Province of Pinar del Rio started a mining activity in Cuba comparable to the excitement caused by the United Verde Extension's developments in our own country. The discovery is said to have been made by a deer hunter who during a rainstorm took shelter under an overhanging ledge—about the only copper exposure on the entire 710 hectares of the Matahambre property

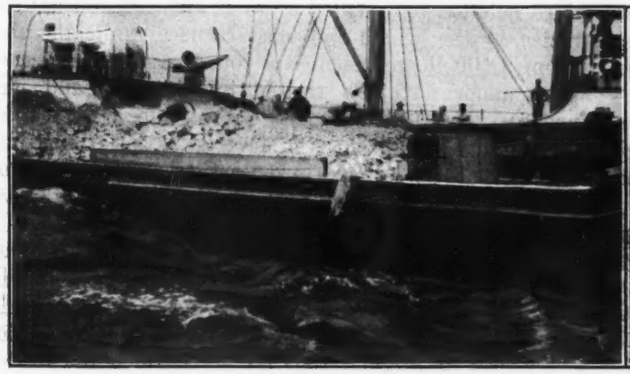
An early panoramic view of the Matahambre development. There are few rock exposures in this region, the hills being covered with drift and grassed over. The country was practically denuded of timber about five years ago by a cyclone; the trunks of many dead trees stil stand, as may be better noted in the top illustration

Santa Lucia, the port of the Matahambre mine, is about 8 km. in an air line and is now being connected with the mine by an aërial tramway. Many improvements have been made at the port, as will be observed by comparison with the illustration on the opposite page

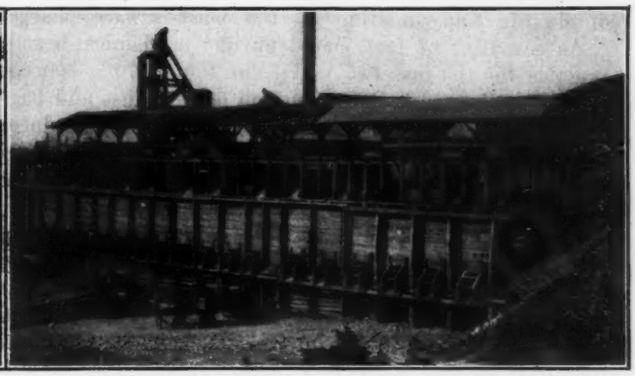
SOME EARLY VIEWS AT THE MATAHAMBRE COPPER MINE IN WESTERN CUBA

A recent panorama at the Matahambre copper mine. The headframe and principal mine buildings are at the right. The dark horizontal line in the right center background is the preliminary grading for a 200-ton mill that has been ordered to treat the second-class ore; the first-class ore is shipped to the United States. The white patches near the top of the hill are gloryholes from which waste is drawn for stope filling. The larger white patch at the left is a dump from one of the tunnels a short distance below "discovery." Shaft at extreme right is now about 500 ft. deep

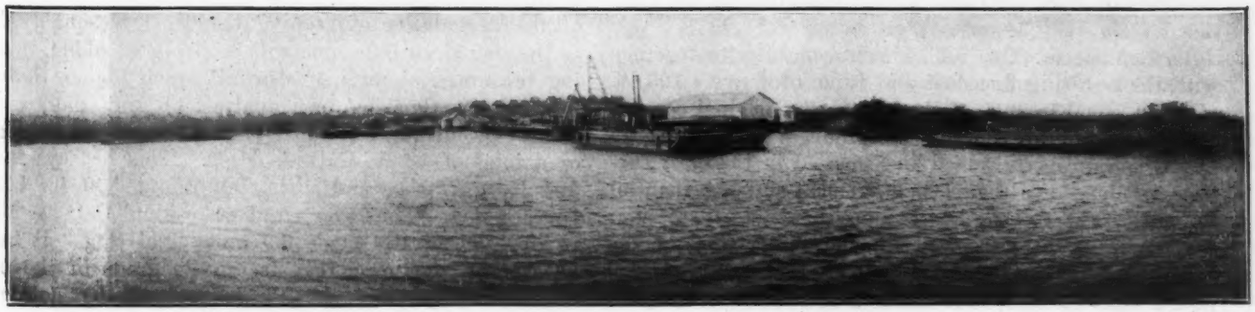
The new assay office and staff house at Matahambre



Loading ore on steamer from lighters



Headframe and new ore bins at the mine



The Matahambre ore is now hauled in wagons to the port of Santa Lucia, pending the completion of the aërial tramway and storage bins. A 1,350-hp. power plant is also to be built at the port. A long channel has been dredged to lighter the ore out to steamers in the open roadstead

LATE VIEWS OF THE MATAHAMBRE MINE, IN PINAR DEL RIO, CUBA

# Correspondence and Discussion

## Lead Smelting Practice

In writing of the Scotch hearth practice in the Mississippi Valley, in the *Journal* of Oct. 7, Arthur S. Dwight, in his article on "Lead-Smelting Practice in the United States," says on page 677:

> **The unsanitary feature of these processes, the large production of lead fumes, difficult to recover and re-treat, and the fact that the gray slags from the hearths have to be put through the blast furnace with sufficient amount of flux to make the same amount of slag that would have been made in a direct smelting of the original concentrates have militated against the hearths.**

Mr. Dwight misses the advantages of the mechanical hearth in the paragraph quoted. The sanitary features as to lead fumes are perfect. The flue dust and baghouse fume are returned to the hearth and are treated with as good or better recovery in lead as the lead concentrates.

The loss of sulphur on the hearth by volatilization is 93%, making the hearth a most efficient desulphurizer and consequently reducing the production of matte in the blast furnace to the minimum; in fact, raw matte must be added to the blast furnace to give the necessary matte fall. The low matte fall reduces losses in lead and cost of re-roasting and smelting the mattes.

The amount of blast-furnace slag produced by the hearth is small and, were it not for the presence of magnesia contained in the gray slag, would be still lower. The low slag fall per ton of original concentrates reduces to a minimum the loss of lead in the slags and also the cost of fluxing and smelting of the blast-furnace charge.

As a matter of fact, based on our mechanical-hearth practice for the last two years, one ton of 70% concentrates together with its production of flue dust and baghouse fume, which is returned to the hearth, produces 79% of the total lead contents in the concentrates as pig lead and 584 lb. gray slag, which is the only product sent to the blast furnace. This gray slag analyzes: Pb, 45%; $SiO_2$, 10; FeO, 15; CaO, 8; MgO, 4 to 5; S, 3 to 3.3%. The actual matte produced from the 584 lb. of gray slag, representing one ton of original concentrates together with its production of flue dust and fume, is less than 50 lb.—equal to a matte fall of 4 to 4½% of the blast-furnace charge—and is due to a further volatilization of sulphur in the blast furnace resulting from the well-known reactions of PbS, PbO and $PbSO_4$ contained in the gray slag.

To summarize: One ton of 70% concentrates together with the resulting flue dust and fume produces 1,106 lb. pig lead, equal to 79% of the lead in the original concentrates. One ton of concentrates produces 584 lb. of gray slag which, properly fluxed and smelted in the blast furnace, produces less than 500 lb. of slag and less than 50 lb. matte.

Comparing these results with the single roast of the Dwight & Lloyd machine and smelting the resulting sinter in the blast furnace, it is found that one ton of original concentrates produces about 1,500 lb. of slag and 500 lb. of matte. The double roast will, no doubt, reduce the production of slag and matte to less than half of this amount, but the mechanical-hearth practice still shows a much less production of slag and matte.

An important smelting company in the Mississippi Valley has recognized the merits of the St. Louis mechanical hearth and is now making a large installation of this type of furnace, to be operated in connection with its large plant of D. & L. machines. HERMAN GARLICHS.

St. Louis, Nov. 6, 1916.

---

Having been favored by Herman Garlichs with an advance copy of his critique on my article on "Lead-Smelting Practice" in the *Journal* of Oct. 7, 1916, I take the opportunity to forward my reply so that it may appear simultaneously with Mr. Garlichs' letter.

Mr. Garlichs cannot have read my article very carefully, for the context clearly shows that the sentence he has quoted did not refer to the Newnam mechanical hearth, but to the old Scotch-hearth practice, before Mr. Newnam introduced his improvements. The next succeeding sentences led up to the first mention of the mechanical hearth, which I said "promises to save the Scotch hearth from extinction." My remarks were intended to be general in character and distinctly appreciative rather than critical.

The additional data furnished by Mr. Garlichs are interesting, but it hardly seems just to compare the amount of slag-fall in the two processes when the material under treatment is widely different. The slag-fall of 500 lb., which he cites, represented a ton of 70% Pb concentrates treated by the hearth and blast furnace, while the slag-fall of 1,500 lb. represented a ton of concentrates averaging under 65% Pb treated by sintering and blast furnace. This latter grade is entirely out of economical reach of the hearth, as I understand Mr. Garlichs himself admits. As I stated in my article, 70% Pb is probably the economical point of division between the two modes of treatment.

The ores of southeastern Missouri, which are here under discussion, have a dolomite-gangue, so that the amount of CaO + MgO is the measure of the slag which must finally be made in the smelting operation. Every unit of residual CaO + MgO which the concentrates contain will cause a theoretical slag-fall of at least 5 units in the final smelting operation, and on account of the desirabiilty of keeping the MgO reasonably low in the slag clean limestone will probably be added, bringing the practical ratio of slag-fall much higher than 5. Taking Mr. Garlichs' own analysis of gray slag, a ton of his concentrates contained 47 lb. CaO and 26 lb. MgO, or a total of 73 lb. CaO + MgO. This he says made 584 lb. gray slag and ultimately about 500 lb. blast-furnace slag. Thus every unit of residual CaO + MgO in the concentrates made 6.9 units final slag. It must be evident, therefore, that as the Pb grade of the concentrates drops and the Pb is replaced by dolomite, the slag-fall must increase at a high ratio. Hence, in making a comparison of processes, it would be only fair to figure on concentrates with the same analysis. It

makes no difference in the mathematics of the fluxing problem whether the flux is added to the gray slag to smelt it, or whether the flux is mixed with the original concentrates being fed to the sintering machines. It is the number of pounds of the refractory elements in the ton of concentrates which will be the measure of the minimum slag-fall in the final smelting.

The increase in quantity of flotation concentrates now being produced in the district under discussion is tending to lower the average grade of the output. These flotation concentrates carry only 40% to 50% Pb and therefore cannot be economically treated on the hearths. A small proportion of very high-grade concentrates may possibly be made which can be advantageously treated on the hearths, but it looks as though the bulk of the tonnage would fall below the critical point of 70% Pb.

New York, Nov. 16, 1916. ARTHUR S. DWIGHT.

## Flotation Test on an Antimony Gold Ore

In reference to the article on "Flotation Tests on an Antimony Gold Ore," in the *Journal* of Nov. 4, 1916, p. 820, I would like to note that the tests discussed were made by E. Clark Will, of Kennecott, Alaska, and me.

Kellogg, Idaho, Nov. 9, 1916. EARL R. PILGRIM.

## Standard Map Conventions

I should like to suggest that the publication, in the *Journal,* of a list of standard conventions for mining maps —both topographical and geological—as well as underground maps, would be of value to many engineers, since there is considerable variation in those now employed at different places. E. B. WOOD.

Bonanza, Calif., Nov. 10, 1916.

[We believe this suggestion is an excellent one. We would like very much to have all engineers interested in this subject, send us their ideas, whereupon we will take pleasure in formulating them and publishing such a list in graphic form.—Editor.].

## Flotation-Efficiency Problem

Suppose the case of a complex ore containing lead and nearly as much iron as the zinc content. The material is treated by the magnetic and ordinary wet-dressing process, resulting in a saving of 70% of the mineral values. Now, presuming that the flotation process is added to the mill equipment, what is its stage in the whole operation of ore treatment? If the tailings are handled, the result is a mixture which must go through the dry and wet mills again to separate out the lead and the worthless iron from the zinc. If the mixture cannot be treated as a separate proposition, but must simply be added to the fresh sizings and handled with them, the proposition of savings made by the flotation process becomes a mathematical problem that on its face does not seem to come out.

If, on the other hand, the crushed ore goes first to the flotation tanks and thence travels the ordinary route provided by a combined dry and wet mill, I can understand how the percentages lost in the tailings are saved. But there are theoretical objections to that method also; and, freely confessing my ignorance and mental fog, I am venturing to ask you to explain in your columns.

Chicago, Ill., Nov. 15, 1916. GRISWOLD KEMPTON.

## Montana Section, A. I. M. E.

At the semi-annual meeting of the Montana section, A. I. M. E., recently held in Butte, Dr. L. D. Ricketts, president of the Institute, was the principal speaker. His subject was committee work applied to technical research, which he developed by showing how historical developments in mining and metallurgy have been evolved mainly by coöperative work in the study of intricate problems. For illustration he mentioned the development of cheaper mining methods at Butte and gave an interesting account of the development of some features of flotation practice. In concluding, Dr. Ricketts suggested that local sections of the Institute select men to study special problems, believing as he did, that such coöperative work among such men would produce important results.

B. B. Thayer, vice-president of the Anaconda Copper Co., gave an interesting account of a trip to South America in company with Dr. Ricketts, Reno H. Sales and others. He expressed a belief in the great future of the country and urged the study of Spanish.

Dr. F. G. Cottrell prophesied that future advances in science would be largely concerned with gases, stating that at Anaconda, for instance, the weight of gaseous products wasted through the stack was twenty times the weight of the slag.

Frederick W. Laist, general manager at Anaconda, discussed features of dust losses at the plant, flotation-practice features, and called attention to the small quantities sometimes dealt with by modern metallurgist—quantities that would have been disregarded not long ago.

C. L. Berrien, assistant general superintendent of the Anaconda mines, made clear how the cut-and-fill system of mining was the only feasible method in Butte because of the necessity of supporting the surface. He said that cost systems which had been introduced for the comparison of the original square-set method with the latest cut-and-fill method showed that a saving of from 15c. to 58c. per ton mined was being saved by the latter. Fifteen per cent. of the square-set stopes had been shifted to the cut-and-fill system in 60 days and the real saving had not yet been shown.

Other speakers were C. W. Goodale, who recalled incidents of the Arizona trip; H. S. Ware, who voiced the appreciation of the Montana members of the hospitality enjoyed in Arizona; Reno H. Sales, who spoke on South American mining; F. E. Marcy and C. R. Kuzell.

## Butte & Superior Mining Co.

The report of the Butte & Superior Mining Co., Butte, Mont., for the third quarter of 1916 shows a total of 136,130 tons of ore milled, with an average of 15.57% zinc and 6.607 oz. silver per ton. Of zinc concentrates 37,333 tons was produced, carrying 39,519,432 lb. of zinc and 21.5 oz. silver per ton. The recovery of zinc in concentrates was 93.314%. Mining cost was $4.9437 per ton, and milling cost, $2.1691 per ton.

Total net income was $1,936,527, and after deducting all expenses, amounting to $988,626, profit of $947,901 remains. Average price used in estimating returns on spelter was 8.3441c. per lb. The regular quarterly dividend was raised from 75c. to $1.25 per share, at which rate dividend was paid on Sept. 30, together with an extra of $5 per share.

# Pinar del Rio Copper Region

By Richard H. Vail

*SYNOPSIS—Impressions of a brief trip through Cuba's new copper district in the western province of Pinar del Rio. Matahambre the only big mine, but other properties have encountered good ore in smaller quantity. Copper showings found over a large area.*

Sugar is king in Cuba, but copper may be said to be queen, for nearly every sugar man now has an interest in copper. The opening of the rich Matahambre copper mine in Pinar del Rio caused a mining furor in Cuba, comparable to that created in the Jerome district in our own country by the development of the United Verde Extension mine. It may therefore be of interest to record some impressions of a hasty trip through the copper region of Pinar del Rio, which is the most westerly province of Cuba, forming the southwestern extremity of that crescent-shaped island. I shall not attempt to give a complete review of the copper-mining activities, but merely present from memory some impression of the region and mention briefly a few of the most important operations. It is worthy of note at the beginning that for many years Cuba's only important copper mine—El Cobre—was in the eastern end of the island, while today its greatest copper mine is at the western end.

### The Developing Copper Properties

As soon as the facts became known about the Matahambre development, much of this region was plastered with denouncements for a distance of about 50 km. along both sides of the Sierra de los Organos. Today the principal developing properties, aside from the Matahambre mine, are, beginning at the north on the western side of the Sierra: Constancia, Mercedita, Malas Aguas, Mono, (Matahambre), Nieves, Otilia, Francisco, La Mejor, San Ramon and Candida. On the eastern side of the Sierra at the south are the Asiento Viejo and Mercedes; at the north, near Viñales, is the Isabel Rosa, also known as the Willetts mine. Besides these properties, more or less closely grouped along the Sierra, active work is in progress at points as far apart as 90 km.—as at the old property near Bahia Honda in the northern part of the province, and at Pueblo Nuevo near Dimas, a port on the western coast. Some of these developing properties have produced sufficient ore to make shipments, while others have only small bunches of ore and are merely prospecting.

The most active copper operations in the province of Pinal del Rio are at a considerable distance from the railroad on the western side of the Sierra de los Organos in a grassy drift-covered country having almost no outcrops. Therefore, though copper was known to exist in this region for many years, it is not to be wondered at that few mines were opened or that little work was done in this end of the island up to the time of the opening of the Matahambre mine. While the Matahambre may be said to be the only "real" mine in this part of Cuba, yet the showings of copper are so persistent along both sides of the Sierra that work is now certain to be done for some time to come in the endeavor to find another Matahambre. Several other orebodies have indeed been opened, but none has yet proved to be of the size of Matahambre. It should be noted, however, that the orebodies have been of good grade in nearly every instance.

The Sierra de los Organos, along which most of the copper mines are grouped, runs in a northeast-southwest direction, approximating the center line of the province of Pinar del Rio. The most striking feature of the Sierra is the limestone ridges or hills, which are more or less bare and precipitous. These limestone hills are sometimes sheer on one or even two sides; hills of this type, when separated, bear the name locally of *magotes*. They have apparently been thrust upward at lines of faulting, though the geology has not been fully studied. The foothills of the Sierra de los Organos are in places approximately as high as the limestone ridges and are frequently separated from them by an area of serpentine, the igneous basement rock of Cuba. In a bulletin[1] issued under the direction of Pablo Ortega, head of the recently-created Dirección de Montes y Minas, the occurrence of basalt, diabase and other igneous rocks is mentioned, but they did not happen to come under my observation. The foothills are drift-covered and show few outcrops. They are grassed over, and there are practically no trees except in gulches or protected hillsides, owing to a "twister" that passed over this section about five years ago. Only a few live palms and the trunks of many dead trees were left. These rolling hills have more the appearance of a typical grazing country than of a mining region.

### Ore Usually Found in Slate or Shale

Most of the orebodies so far disclosed have been found in the shattered slates or shales in the foothills to the west of the Sierra, though in the case of the Constancia mine the ore was reported to have been found in lenses in the serpentine and at the contact of serpentine and limestone (?). In no instance that I observed had any mines been opened at the contact of the surpentine with the *magotes* or the main limestone ridge, and no prospecting of consequence was in progress at this contact. Whether this was because of no visible copper minerals, or because such areas had been investigated and found barren, I do not know.

### Matahambre Discovered by a Hunter

The Matahambre mine, which caused the present copper-mining activity in Pinar del Rio, is situated in the foothills on the western side of the Sierra at an altitude of less than 500 ft. and only about 8 km. from the port of Santa Lucia. I shall not attempt to describe the Matahambre mine, but merely touch upon a few interesting facts about this property. Matahambre Hill is typically grass-covered, and the discovery of the mine was purely fortuitous. A hunter caught in a rainstorm is said to have sought shelter under the overhanging ledge

[1] "Boletin de Minas," Num. 1, July, 1916; dirección de Montes y Minas, Secretaria de Agricultura, Comercio y Trabajo, Habana, Cuba.

of a small gulch. While waiting for the rain to cease, he noticed some peculiar-looking rock—the only copper outcrop on the Matahambre property of 710 hectares. The peculiar color induced him to take some of the rock, which eventually was shown to Dr. Alfredo Porta in the town of Pinar del Rio. Dr. Porta interested Manuel Luciano Diaz, a well-known civil engineer of Havana, who in 1913 began the development of the property. Rich ore was opened by an exploratory adit, and before the end of a year enough ore had been shipped to put the mine "on velvet." Developments continued most favorable for a time, but presently the original orebody came to an end in a gouge against the slate wall. However, the shaft then being sunk at a considerable distance laterally, was in ore at a point lower down the hill and D. Ford McCormick, who was placed in charge of the mining work at this time, decided after some study of the local conditions to drive through the slip. After going over 100 ft. in barren slate, the miners broke into a good-sized lens of nearly solid chalcopyrite ore. This gave the key to the development of the "greater Matahambre mine," now opened to the eighth level, with the shaft being sunk to the ninth and already about 50 ft. below sea level. Native copper and almost every copper mineral from oxide to sulphide have been found in the Matahambre mine, but chalcopyrite is the predominant mineral. The country is slate, much shattered, and with frequent lateral faults. The orebodies generally are at an angle of about 45°. Sufficient ore has now been developed to warrant the erection of an 8-km. aërial tramway to the port of Santa Lucia, the building of port works, a 1,350-hp. crude-oil engine power plant at Santa Lucia, an electric transmission line to the mine and a 200-ton mill on Matahambre Hill to treat second-class ore. Shipments during the rainy season at the time of my visit were amounting to 5,000 or 6,000 tons per month of 14% ore. Additional teaming arrangements were being made to bring this tonnage up to 7,000 or 9,000 tons, pending the completion of the tramway in February or March. Martin Young is general superintendent, while D. Ford McCormick directs the technical work, with the title of "engineer in charge." The Matahambre and most of the other properties near the northern end of the Sierra are usually reached by leaving the Western R.R. of Havana at Pinar del Rio, whence a *guagua,* or stage line, can be taken to Viñales, and La Playa de Esperanza. To reach Matahambre from Esperanza, one proceeds by launch to Santa Lucia, thence on horseback to the mine.

### Developing Properties on Western Slope

Of the other mines at the northern end of the Sierra, I visited the Constancia and Nieves. The Constancia, north of Viñales, is an old property, formerly worked by the McLoughlins, of New York, who took out considerable ore. This property is now being developed by M. Paetzold, Austrian consul at Havana. The work is in charge of Marco Laiz, *administrador,* though lately C. Leslie Bruns, an American engineer in charge of Mina Mercedita, has been called in to advise regarding developments. The main feature of interest here is that the orebodies are reported to be found in the serpentine or at the contact of the serpentine and limestone (?), while at most of the other properties on the western side of the Sierra, the ore occurs in the fractured slates and shales. Another feature of interest at the Constancia is the copper mineral, cubanite, a copper-iron sulphide lower in copper (about 25%) than chalcopyrite but occurring fairly pure. Several hundred tons of this cubanite ore on the Constancia dumps are locally estimated to have a copper tenor of approximately 18%. One who is unfamiliar with this ore is astonished at its high copper content, as it appears at first glance to be a low-grade chalcopyrite ore.

I did not visit Mercedita, Malas Aguas (Cosmopolita) or Mono. All are reported to have encountered some bunches of ore, but no orebodies of commercial size. At Malas Aguas, though a number of shafts had been sunk, development lately has been by drilling, which I was told was difficult and expensive owing to the fractured condition of the country. This is probably the reason why prospecting by this method is not generally done.

Going south from Matahambre the first development encountered is that of the Cia. Minera Nieves, which is installing a new surface equipment, consisting of Chicago Pneumatic air compressor, Bolinders oil engine, Jackhamer drills, etc., for the prospecting of a strong pyrite or pyrrhotite vein carrying a small percentage of copper. This vein is developed by shaft. The company also has work in progress in two adits in other parts of the property. Continuing southward, no active properties are encountered until near Gramales, where the Otilia is being developed by a syndicate of Cienfuegos men.

### Promising Area Near Southern End of the Sierra

Still farther south, a group of properties under active exploitation are the Francisco, La Mejor, San Ramon and Candida. The developments here are mainly by adits and shallow shafts—the latter as yet less than 200 ft. deep. These mines are all in promising ground and have found some ore in the fractured shale. At the moment the Francisco has the most ore, though Candida has shipped about 3,000 tons from a high-grade pocket. Candida, Francisco and La Mejor are now in the hands of American engineers, and their development is receiving intelligent attention. Whether another Matahambre will be developed remains to be seen. A feature of these southern properties, especially at Francisco and at La Mejor, is the strong "gossan" outcrops—Francisco was in fact originally denounced as an iron property; however, adits run in to cut these outcrops have found nothing at the points expected, though the country is so broken that no conclusions may be drawn from this work as yet. At the Candida, Carl A. Lewis, formerly at Mapimi, Mexico, has lately been put in charge of the technical work; Chester A. Fulton is directing the work of La Mejor Mining Co., and William E. Fenwick is engineer for the Francisco Mining Co. The San Ramon, which I did not visit, is in charge of a Mexican engineer, Ignacio Quintanilla, for a Cienfuegos syndicate. Much of the energy of these four companies to date has necessarily been devoted to road building. They are reached from Guane, the rail end of the Western R.R.; thence by *guagua* (Ford stage line) to Los Acostas, which is the mail point for the mines. From Los Acostas one usually proceeds on horseback to the mines, but the roads will soon permit of driving. Candida, the mine of Gen. José Miguel Gomez, uses the port of Dimas for shipping its ores, though the Francisco will ship to Guane.

Near Los Acostas, but on the eastern side of the range, is the property of the Cia. Minera Asiento Veijo. I

did not have time to visit this property, but was told that several hundred tons of ore has been shipped therefrom; I was informed that the ore generally is not so high in grade as at some of the other Pinar del Rio properties. This stock is listed on the Bolsa in Havana. Recently, it was reported that the property was to be purchased by a "French syndicate" for $3,000,000. On the strength of this report, the stock was heavily traded in, skyrocketed to a high figure and then slumped when the sale to the "French syndicate" did not materialize. This left a rather bad taste in the mouth of the public as regards mining speculation. Asiento Viejo, however, has just made another shipment of 100 tons to the United States and has improved the road for hauling further shipments to Dimas. A concentrator is under consideration. The Mercedes mine, also situated near the southern end of the range on the eastern side, was for some time under development by the Cia. Minera Buena Vista, but I understand that the option has now been relinquished. This company also operates the prospect at Malas Aguas.

At the north on the eastern side of the Sierra, near Kilometer 12 on the *carretera* from Pinar del Rio to Viñales, Robert Willetts has been developing the Isabel Rosa mine, which has lately been taken over by interests for whom Chester A. Fulton is engineer. About 150 tons of cubanite ore, occurring in slate, has been taken out in development here; the shaft is now being sunk to a depth of 100 ft.

A deterrent to the entrance of American capital in this region is the high royalty asked. It is currently reported that Dr. Porta, who controls the Matahambre area, has a 40% interest in the profits. This may or may not be correct; only a mine like Matahambre could stand such a tax. Few mining operators in the United States would pay 25% or even 15% to prospect a drift-covered area that only has a chance of containing a Matahambre. As is inevitable in the rapid development of a new region, some of the work has been injudiciously done, but gradually the wisdom of securing technical advice is being appreciated. A number of companies are now employing competent American engineers, and if the latter be given a free hand, these properties will be assured a thorough and intelligent development. Unfortunately, in some instances, the Latin system of dual management prevails—an *administrador* and a technical manager—with its attendant expense and occasional comflicts of authority. Many of these properties have not yet been developed to a stage warranting such an expensive form of management, but Cuban opinion considers it more safe and apparently does not realize that technical men of integrity can be secured and that thousands of mines are successfully run in the States under single management.

Just what the future holds out for Pinar del Rio as a copper region is uncertain. Another year's development should give considerable light on this question. There is a remarkable persistence of copper occurrence for 50 km. more or less on both sides of the Sierra de los Organos, and it would certainly be a curious thing if Matahambre were the only concentration of great extent. The surface indications are not more favorable at Matahambre than at numerous other places. Good orebodies of modest dimensions have already been found, but as to another Matahambre—it took a long time to find another United Verde.

## Engineers' Library Endowment

Dr. James Douglas, of New York, has presented $100,000 to the United Engineering Society, the income to be used for the benefit of the library. The trustees of the society have perfected plans for the development and extension of the usefulness of this great engineering library and are endeavoring to secure endowments aggregating $1,000,000, the income to be used for the library.

The plans of the trustees, having been submitted to and carefully examined by Dr. Douglas, have been approved by him and he has signified this approval by his gift of $100,000, which has just been made. Now that the library of the American Society of Civil Engineers has been united with the libraries of the institutes of mining, mechanical and electrical engineers in the building of the United Engineering Society, in West 39th St., New York, the combined library forms the greatest engineering collection in the world. It is the purpose of the trustees to extend greatly its usefulness, and it is hoped that the splendid indorsement which Dr. Douglas has given will stimulate other similar endowments until the necessary million dollars has been obtained.

## American Mining Congress

SPECIAL CORRESPONDENCE

By a unanimous vote the American Mining Congress, which closed its sessions at Chicago, Ill., on Friday, Nov. 17, adopted a resolution putting the congress unqualifiedly on record as favoring "a competent nonpolitical commission" to investigate the defects of the Federal mining laws. The commission desired by the congress would recommend to the Federal lawmakers the remedial legislation thought necessary and would sit in Washington as an advisory body during the consideration of the legislation. The lack of a single voice in opposition to the resolution, as well as the outspoken opinion of many, indicated that operators of coal and of metal mines resent the lack of consideration given the mining industry by the House Committee on Mines and Mining. Since the committee declined to approve of an investigating committee, it was pointed out that most operators had given serious consideration to the proposal that the mining laws be revised without the preliminary investigation. It was declared at meetings of the mining congress that no operator believes the law can be revised intelligently without this investigation. The need for a more suitable code is so great, however, that many favor an attempt to draft a law without the commission, if continued opposition to the commission plan should develop at the coming session of Congress.

Carl Scholz, who has been president of the mining congress for three years, thwarted all efforts to secure his renomination, and the presidency went to Walter Douglas, of Phelps, Dodge & Co. No other nominations were made, and Mr. Douglas was elected by acclamation. George H. Crosby, of Duluth, Minn., and Irving T. Snyder, of Denver, Colo., were elected to fill vacancies on the board of directors; W. R. Richards, of Pottsville, Penn., and M. N. Kemmerer, of New York City, were reëlected to places on the board of directors.

While fifteen cities submitted invitations for the convention next year, it is believed that Birmingham, Ala., found most favor with the members present at Chicago.

No one of the nineteen conventions held by the congress ever has gone to the south. Another argument is that Birmingham combines the coal- and metal-producing districts, in each of which there is much popular interest.

Steps taken by the uniform-legislation section of the convention toward the drafting of a coal-mining code are confined entirely to coal mining. It was explained that it is not the intention of the Uniform Mining Laws' Association (organized at the convention as a separate entity), to consider the application of their proposals to metal mining.

The only resolution adopted at the convention which seriously divided the Resolutions Committee was the one introduced by L. W. Trumbull, state geologist of Wyoming, in which it was urged that the Department of the Interior construe the public-land laws more liberally. The resolution, which passed the general assembly of the congress with few dissenting votes, put the congress on record as being unalterably opposed to any system of Federal leasing of mineral and other land or the enactment by Congress of any laws relating to public lands, the effect of which is to restrict the development of the West.

The attendance of members from the metalliferous sections of the country was unusually light. This was explained by those who did attend, as being the result of the prosperous condition of the industry. In the effort to keep production at the highest possible point, comparatively few operators of metal mines feel that they can spare any time away from their properties. Even the coal men from the fields adjacent to Chicago did not stay through the entire convention. Many of these operators selected the days on which the topics in which they would be most interested were to be discussed and limited their stay to just that time. In this way the attendance was evenly distributed throughout the convention and a minimum amount of time was lost by the operators from their desks. Distance made this procedure impossible for metal-mine operators. Unfortunately for the maximum success of the metalliferous section, a number of those having promised to read papers were prevented from being present.

### The Oil Flotation Session

The most successful session was that of Wednesday afternoon, when an extended discussion of flotation problems took place. It was at this session that the paper on "Oil Flotation," by Dorsey A. Lyon, of the Bureau of Mines, was presented. Mr. Lyon is in charge of the bureau's Salt Lake City station. He summarizes the work done in the extended study which has been made of the low-grade and complex ores of Utah, as follows: "The development of a brine-leaching process for extracting lead from low-grade and complex ores; the development of a process for the recovery of lead and zinc from lead-zinc sulphides; the application of the flotation process to the recovery of lead in carbonate ores; the development of a process for the recovery of zinc from low-grade and complex ores of that metal, and the development of a process for the production of zinc dust from solutions of zinc."

The social features of the convention were very successful. At the smoker Tuesday night, more than 600 members and their guests gathered in the ballroom of Hotel La Salle and joined in singing old-time songs. Well-selected refreshments in substantial quantities were served. Singers, who adopted the cabaret style, added much to the merriment of the evening.

The banquet Thursday night brought forth notable toasts from Col. George Pope, of Hartford, Conn., and from Judge Frank H. Short, of Fresno, Calif. Col. George T. Buckingham, of Chicago, was toastmaster. The banquet was made the occasion for the presentation to Carl Scholz, the retiring president of the congress, of a $300 gold watch. The presentation was done cleverly. Immediately on the assembling of the guests, Mr. Scholz, in turning the direction of the affair over to the toastmaster, announced the election of Walter Douglas as president of the congress. He had launched into his own farewell address, when he was interrupted by E. W. Parker, of the Anthracite Bureau of Information. Mr. Parker began a discussion as to "time." He talked about springtime and its relation to wintertime. He discussed the advantages of Eastern time and Central time. He compared the general conception of a good time with the time of adversity. As Mr. Parker's rambling talk continued, the perturbation of Mr. Scholz increased, as he knew nothing of the plan. Finally he turned to Toastmaster Buckingham and asked if, by any chance, Mr. Parker had broken the rule of a lifetime and indulged in intoxicants. His perplexity was short-lived, as Mr. Parker cut short his dissertation on "time" by dangling the watch before the astonished eyes of the retiring president, saying that the time kept by the watch he held was declared to be as exact as human ingenuity could devise. The watch was a token of the esteem in which the members hold Mr. Scholz, thrice elected to the highest office of the congress.

### Judge Short's Parable

Judge Short based his talk on a parable, which in substance is as follows: "The Sam family was one of wealth. The father, Uncle Sam, divided the property equally between his sons, North, East, South and West. The portions which fell to the three older sons were awarded them and placed at their disposal at once. The youngest son, West, assigned his portion of the estate so early in life, was unable to take advantage of it as had his brothers. After having had full benefit of their part of the estate and seeing the great value of their brother's estate, North, East and South came to the conclusion that West's estate should be handled so that the profit accruing from it would be divided equally among them all." Judge Short, from this parable, developed a convincing argument in favor of the Western idea of conservation.

Colonel Pope, in his toast, dwelt on the kinship between mining and manufacturing. He pointed out that the mine operator often loses sight of the fact that the manufacturer is more than a consumer of the raw material he produces. He emphasized the fact that the manufacturer also bears a very important relationship to the mining industry in that he perfects and makes machinery without which the operation of mines on any but the primitive scale would be impossible.

**Tungsten in New Brunswick** is the latest development. The "Canadian Engineer" reports that tungsten deposits are now being worked experimentally near the banks of the Miramichi River, in New Brunswick. Three veins of ore are reported, one being 26 in. thick. A concentrating plant of 20 tons daily capacity and a crusher have been installed.

# Editorials

## The Situation in Copper

The present situation in copper is unprecedented. The causes leading up to it are clear. With a shortage of refining capacity and difficulty of increasing it, a large part of the expected production during the first half of 1917 was taken out of the market by one huge purchase by the allied governments. Domestic users of copper subsequently became panic-stricken and rushed to buy the remainder of the probable output up to the middle of 1917.

Therefore we find ourselves in the situation where nearly all of the expected production for seven months ahead has been sold. Conversely, it is probable that the expected requirements have been covered. The brutal, reckless buying of the last fortnight must mark the culmination, or the close approach to it, of the satisfying of the large needs.

Cessation of buying there must be some day. Then we shall face the position where all the copper to be produced for six or seven months ahead has been sold and all the copper to be needed has been bought. Buying may then extend into the second half of 1917, as it has already upon a relatively small scale, but sooner or later there must be a halt in the recklessness of people committing themselves so far ahead.

Assuming that presently there will develop such a halt, we may expect a prolonged period of dullness in the market, for producers will have no more copper to sell and users will need to buy no more. There will, however, be a copper market on small transactions, for there will be some users who have held aloof, with the nerve to take their chances later on, while on the other hand there will be some who will find themselves overbought and will be desirous of reselling. Moreover, producers will come into possession of small supplies held in reserve for safety in conducting their business, which will be gradually released as time wears on. And there will be other ameliorative factors.

As between production and consumption, we are probably approaching a state of equilibrium. During the recent excitement there has been undoubtedly a tendency to overestimate the consumption and underestimate the production. The purchases by the allied governments for delivery in the first half of 1917 call for about 480,000,000 lb., or about 80,000,000 lb. per month. This is not an addition to the normal exports figured on the basis of 1916. Rather is it simply a replacement of them. We are prone to shut our eyes to the fact that the allied governments have not been buying all this copper for military purposes alone, but rather for the entire consumption of their countries, the industries of which they have mobilized and taken in hand.

There has been some outside buying from both Great Britain and France, which is permitted under certain circumstances, and from other countries. Let us estimate this at 120,000,000 lb., calling for the export of about 20,000,000 lb. per month. We shall then have a total contemplated export of 100,000,000 lb. per month to go out, not 160,000,000 lb. per month, which is assumed by adding 100,000,000 to 60,000,000—the latter being the average rate of 1916. The domestic use of copper will be probably about 125,000,000 lb. Thus the total requirement will be around 225,000,000 lb. per month. The outlook is that the production will be at approximately the same figure, probably more rather than less. This is about the way things look now.

However, there are numerous factors that may enter into the situation as time passes, and will have a general tendency toward amelioration of the stringency. During the first nine months of 1916 the exportation of copper in bars, plates, ingots and rods averaged 61,500,000 lb. per month.[1] If Europe is going to take 100,000,000 lb. per month in 1917 instead of about 60,000,000 as in 1916, there is ground for the suspicion that she has contracted for more than she really needs, in order to be on the safe side. However, it is to be remarked that Great Britain and France are probably going to manufacture wares that they have previously got from this country. On the other hand, the refiners have probably been conservative in contracting to deliver what they expect to produce, and as time rolls on will most likely find their actual output greater than reckoned. Of course, everybody knows now that the stringency in copper is due to shortage of electrolytic refining capacity. The high prices will undoubtedly stimulate further the production of lake copper, which requires only a furnace refining, and moreover, we shall see an increased use of blister copper low in silver—such as the Arizona, Braden, Detroit, Tennessee, and Miami—which can be refined in furnaces up to 99.75% Cu and can be marketed as "best selected."

Everybody will say that this is no time to consider statistics. The market has gone up because consumers have insisted on buying. If a producer did not sell to one, he could to another, for many were begging him to let them have copper. But without any doubt the extraordinary situation of the last few weeks has resulted from the failure of consumers to appreciate the statistical position, and becoming panic-stricken, they insisted upon buying all their next six months' supply at once. Exactly the same thing happened in spelter in 1915. If the allied governments had deferred their large purchases and taken 80,000,000 lb. per month, or if domestic consumers had not become scared, the copper market would probably have moved along in an orderly way, with the possibility, perhaps, that the allied governments might have paid more and the domestic consumers less.

The producers have now sold about all of their first-half 1917 copper at prices ranging from 24 to 32c. per lb., the bulk of it under the arithmetical mean of 28c. When the present storm abates and calm ensues, we may expect a prolonged period of dullness, during which the market

[1]Last year the Government altered the form of its copper statistics and is now including the exports of rods with the statement of bars and ingots, thus embracing a manufactured product with what is properly the refiners' product. Formerly rods were grouped with wire, which is more correct.

will be established on relatively small sales, for it is not to be expected that consumers will buy furiously all the time for long distances ahead.

## Revision of the Mining Laws

We have referred several times to the discussions by the several mining societies of the United States respecting revision of the mining laws and the expression of opinion upon a series of questions that were proposed. The vote upon those questions, which is reported in the last bulletin of the Mining and Metallurgical Society of America, is highly illuminating. It will be recollected that the M. M. S. A. invited all the other national societies and also the several state societies to vote upon the same questionnaire. The Northwest Mining Association, the California Metal Producers' Association, the Nevada Mine Operators' Association and the Colorado Scientific Society did so.

Let us consider first the vote of the M. M. S. A. This is a national society. Its membership is small, but is representative and influential. Of its members 123 voted, a rather large vote by percentage. Foreign members did not vote, nor did many members who are metallurgists rather than miners. Moreover, many members engaged in mining in Eastern districts excused themselves from voting on questions pertaining especially to the public lands of the West, as to which they professed ignorance.

The vote of the M. M. S. A. showed that while with regard to questions of detail, such as the size of claims and the orientation of lines, there was difference of opinion—sometimes to the extent of a nearly equally divided vote—upon all fundamental questions there was all but unanimity.

On the proposition that in a revision of the mining laws it should be aimed to preserve to the maximum extent the phraseology of the present laws and their principles of administration, the vote was 110 in the affirmative and 4 in the negative. It was voted 116 to 1 that a new mining law should be made to cover all classes of valuable mineral deposits other than coal and that this intention be so clearly defined that there will be no misunderstanding of it. On the proposition that the new law shall authorize mineral locations *without* discovery in any part of the public lands officially classed as mineral and *upon* discovery in any part of the public lands whether officially classed as mineral or nonmineral, the vote was "yes," 83, "no," 15. That there be further a provision permitting bona fide prospecting on land classified as nonmineral and protecting the prospector in the meanwhile was voted 110 to 3. By almost equally sweeping vote it was the consensus of opinion, however, that patents should not be granted until discoveries had been made.

The question as to whether the number of claims locatable by one person or association be limited or unlimited developed a closer division of opinion, 42 voting "limited" and 60 "unlimited." However, the propositions that existing regulations respecting the marking, notice and recording of location be continued, that the recording must be done within 90 days, that there be emphatic provisions to insure the honest performance of annual assessment work and that proceedings for patent remain as now were carried sweepingly by votes of 91 to 3, 94 to 9, 110 to 2 and 73 to 16 respectively.

Most interesting of all, of course, was the vote respecting abolition of extralateral rights, for it was dissatisfaction with the law of the apex that started the agitation for revision of the mining laws. This question was put in the form of a memorandum that had previously been adopted by the New York section of the society, as follows:

> **Subject to the existing extralateral rights of mining claimants or patentees, the holder or patentee of a mining claim located hereafter to have the exclusive right of possession and enjoyment of the surface held by him and of the minerals under it, bounded by vertical planes passing through surface boundaries of said land, but not the right to follow any mineral deposit beyond said planes. And the holders or patentees of claims heretofore located to have similar exclusive possession of all the mineral in said claims that is not covered by any existing extralateral rights.**
>
> **The above article abolishes extralateral rights in so far as any claims hereafter to be located are concerned. The extralateral rights of existing claims may not be taken away. however, wherefore any new location and grant of patent may be made only with the reservation of such rights. The rights of existing claims having been thus expressly preserved, the last sentence of this article confers upon previously located claims the rights to everything comprised within the vertical projection downward of their side lines that is not legally claimed by anybody else, this being thus an addition to the original extralateral rights.**

Members were asked to vote approval or disapproval of the above. The vote was 120 "yes," 1 "no."

It was voted 106 to 8 that there ought to be provision for appeals from decisions of the United States Land Office to a court of competent jurisdiction.

So much for the Mining and Metallurgical Society. The other national societies made no returns. Four state societies did so, but their machinery did not in all cases permit of definite expression of opinion. The Northwest Mining Association and the Nevada Mine Operators' Association voted officially as bodies. The California Metal Producers' Association issued ballots and filed those that were returned. The Colorado Scientific Society referred the questionnaire to a committee and returned the report of that committee.

With a few exceptions these organizations voted in the same way as the Mining and Metallurgical Society upon the main questions that have been summarized in this article. The California Metal Producers' Association by a vote of 5 to 4 declared in favor of limiting the number of locations. The Colorado Scientific Society is unwilling to see the requirement of discovery abolished, but desires that actual possession of a delimited claim be legalized pending bona fide effort to make discovery. Otherwise the differences among the several organizations relate mainly to details. In this connection it is interesting to call attention to the matter of size of claims, wherein are reflected differences of opinion arising from environment and experience. The Northwestern mining men are strongly in favor of a claim not less than 1,320 ft. square (40 acres). They have come most in contact with British Columbia practice, where the claim unit is 1,500x1,500 ft. The Colorado men are divided between large claims (40-acre maximum) and small ones (2½-acre minimum). The Southwest men generally favor a small claim. They have had experience with the small *pertenencias* of Mexico.

It is singularly gratifying that the general expression of opinion as to revision of the mining laws of the United States thus obtained through the medium of the Mining and Metallurgical Society has been so harmonious upon all main points. It ought not, with this information, to

be difficult to proceed to draft for introduction in Congress a bill that will be what mining men want. The matter now stands in much the same way that it would if a commission had toured the United States and obtained oral expressions of opinions in several mining centers and tabulated them. The present expression of opinion is probably more representative, for it summarizes votes not merely from a few places but from many, scattered all over the United States, and moreover it follows a prolonged discussion—extending through several years—in the course of which all kinds of views have been advanced and considered.

It will now naturally devolve upon some committee to consider the wishes of the mining industry and weld them into a properly phrased measure to be offered in Congress. Without any doubt the Mining and Metallurgical Society will proceed to take this next step with the same broad view that it has had in taking the previous ones; that is, assuming only the leadership in getting something done and inviting the coöperation of everybody interested. The purpose is manifestly to produce a "mining men's bill," embodying what mining men want. It is to be expected that whatever committee undertakes this will have adequate legal assistance, and moreover that it will publish its proceedings as it goes along. This will not be altogether an untried experiment in framing legislation. The model bill drafted by the Committee on the Prevention of Accidents in Metal Mines (published in U. S. Bureau of Mines Bulletin No. 75), which has been enacted with trifling modifications by several mining states, is evidence of what a committee of engineers can do in such things.

## Spanish-American Scholarships

Peace advocates are not all theorists. According to the *Evening Post* the peace committee of the Philadelphia yearly meeting of the Society of Friends (Quakers) is urging the foundation of university scholarships for the benefit of properly prepared Mexican students. They feel that friendly relations will be stimulated by facilitating the acquisition of an education on American soil with American surroundings. Haverford College has already responded by offering two such scholarships.

This is constructive peace work that may well be imitated by our mining schools with relation to all the Spanish-American republics. The more residents of those lands who have acquired their education in this country, the more who have learned to know us as we really are, the less will be the feeling of distrust now so prevalent in some Spanish-American states.

Not only will this be good work from the point of view of peace for peace sake, but it will be good business from a broader point of view. Many of our mining schools are not overcrowded at the present time, their facilities are not being used to capacity; they could easily afford several scholarships at $200 to $500 without materially increasing their budgets, and the good that would result would be vastly in excess of the cost.

The popular slogan at the present time is, "Increase of of foreign commerce." We miners know that it has been the seeker of minerals and metals who has been the pioneer ever since the Western Hemisphere was discovered. He has gone into the wilderness where the railways, the farmers and bankers have followed him, and we know that if our people expand their mining interests in the southern republics, other commercial enterprises are bound to follow; and as these develop and are properly nurtured, the inducements to maintain peace and amicable relations must grow. We believe that engineering education acquired by foreigners in this country will be a means of stimulating friendly and business relations to a very marked degree.

## The Boom in Copper Stocks

Last week saw the development of a real boom in copper stocks. During the six days ending with Nov. 19 Utah advanced 12 points to 130, Kennecott 8½ to 63½, Inspiration 7 to 74½, Chino 8 to 74, Granby 24 to 120, Ray 4 to 36½, Miami 7 to 48 and Chile 16 to 39. All these prices were the highest ever recorded. Anaconda was conspicuous by its moderation, its advance for the week being only about 6 points, its closing being about 105, a figure far below what its predecessor—Amalgamated—had realized in former years.

The violent advance in these stocks was based primarily upon general appreciation of the phenomenal position to which the copper companies had arrived. Starting from this, the public came into the market and bought recklessly, crazily. Intrinsic value was no consideration. People bought stocks simply because they thought they were going up. The motive for the mad advance on Nov. 18 was a rumor that there was to be a consolidation of Utah, Kennecott, Cerro de Pasco, Chile, Nevada and Inspiration. Why Chino and Ray should have been omitted and why Inspiration was included nobody stopped to think, nor was there any heed of what Washington might say of such a project. Consolidation rumors are the old baits, and never-failing ones, to appeal to speculative imagination. The market was in the hands of people intoxicated by the ecstacy of profits.

Many of the copper-producing companies have long been selling at less than their intrinsic value. Some of them are not yet selling for more than they are really worth. But a good many are now selling for far more than they are worth, giving them full credit for all that is to accrue to them from their sales of copper extending to the middle of 1917. However, nothing of this sort has received consideration. The keynote has been simply to buy anything. The denouement is, of course, inevitable. Some day the buying power will exhaust itself, the pools will have distributed their holdings, the public will have the stocks, and when the last buyers become tired and try to realize, the break will come. But in the meanwhile the gold inflation provides great buying power.

A curious thing about the recent rise in copper stocks has been the relative sluggishness of Anaconda, which up to about six weeks ago was historically the leader of the market. A broad swing without Anaconda heading the list was hardly conceivable. The present rise started with Anaconda and Utah both at about 90. Utah rose to 130, while Anaconda went only to 105. Comparing with the low points of 1914, Utah more than tripled in price, while Anaconda but little more than doubled.

Some judges express the opinion that the rises both in copper metal and in copper stocks are approaching culmination. As to the metal, when producers have sold

all they expect to turn out during the first half of 1917 and conversely consumers have bought all they expect to use, there must be a halt unless buying and selling extends generally into the second half of 1917; but there must be some time when ordinary prudence will check future commitments. As to the copper stocks, the rise was based on an appreciation of the great profits accruing to the producers. The sharp advances in copper added fillips to the imagination, but no longer do they amount to anything. If the producers have sold at 24@ 32c. all the copper they expect to produce up to the middle of 1917, it will not add anything to their income if speculators sell a few million pounds at 35c., or 45c., or 55c. It was therefore necessary to have some stronger medicine to keep the stock market going, wherefore on Nov. 18 there were circulated rumors of a big consolidation of copper companies. This looked much like administering strychnine to a tiring horse. Of course ideas of such a consolidation were all moonshine, but the rumors served their purpose.

## BY THE WAY

"But Wall Street must have news. It feels that it must have some excuse, outside of general conditions, for putting prices up. If it cannot get news, it will take rumors." The witty writer of Wall St. Paragraphs in the *Evening Post* thus begins his comment on the copper consolidation rumor of last week, and continues: "There are the the copper stocks. Wall street long wondered why the copper stocks did not move. Their earnings were phenomenal. They were constantly increasing their dividend distributions. And when the coppers began to advance, the advance was at first attributed to the discounting of past and present earnings and dividends. But as the advance went further the old explanation was found unsatisfactory, unsuitable; and so rumors were spread around of future dividend increases and future orders. And these dividend increases and future orders came; there was placed with the copper companies of this country the largest single order they had ever received in their history; it was so great that it was equal to about one-quarter of their annual capacity; it was greater than even the most optimistic forecasts had believed it would be. The copper stocks took an upward leap. But the leap was not great; it was short-lived, and people began looking about for a further stimulus. They talked of higher prices for the metal. Even these came; the metal went to the highest price since electrolytic copper was invented. The copper stocks again began to soar. This time their gains were greater and more sudden than ever before. Some parts of Wall Street could not see how the record price for the metal could be causing this. And so merger rumors were started. The beauty of a merger rumor is the element of mystery. If you hear that the earnings of the So-and-So copper corporation have increased so much, you know just about what that will mean to the price. But you really do not know exactly what a given merger will mean to the value of a security. Hence there is a glamour about it. You hear of a merger of copper companies with mines spread all over the country. You cannot see how that will effect any economies in production. You cannot see how that will lead to any increase in efficiency. You can see that if the merger is large enough it may be able to exercise greater control over the output, and hence the price of the metal; but you would naturally imagine that if the merger were big enough to do that, it would be big enough for the Department of Justice to call a halt."

## Quantitative Microscopy

In copper refineries it has for some time been a custom to determine the copper oxide in refined copper by making photomicrographs, weighing the same, cutting out the portions showing oxide, and weighing again. This gives the relative areas of the oxide and nonoxide portions. Quantitative photomicrography is a new art of the analyst that promises much usefulness.

In the *Journal* of the American Chemical Society, 1916, XXXVIII, 1647-58, F. E. Wright states that it is possible with the aid of the petrographic microscope to measure readily and with sufficient accuracy the optical constants of crystal grains measuring only 0.01 mm. in diameter. He discusses briefly the application of the instrument to chemical problems. It is possible, for example, to identify any one of the pentose- and hexose-osazones by means of their optical constants, even though only a few miligrams of substance is available. In the identification of alkaloids also, where chemical methods are unsatisfactory or difficult to apply, the petrographic microscope should prove of value. Other applications mentioned include the examination of baking and cleaning powders, abrasives, paints, fertilizers, cements, drugs, sugars, salt and photographic developers.

At a recent meeting of the Society of Public Analysts, in London, T. E. Wallis said that quantitative results based on microscopical work have hitherto failed to obtain recognition such as is accorded to similar results based upon chemical processes. By adopting the procedure outlined below, a high degree of precision can be given to quantitative work with the microscope, which has a unique value in those instances where chemical methods are inapplicable. Equal weights of the material under investigation and of a standard mixture for comparison are mixed separately with similar weighed quantities of lycopodium spores. The mixed powders are suspended in a suitable fluid, and two slides are prepared from each suspension. Ten fields, selected according to a prearranged plan, are counted on each slide, and the average ratio of the number of particles of substance to be determined, to the number of lycopodium spores present, is found, and reduced in each case to the number corresponding to 100 lycopodium spores. The figures so obtained are proportional to the quantities of material present in the substance and in the standard mixture respectively. A simple calculation gives the quantity sought. The accuracy and utility of the method were shown by experiments with typical mixtures, including wheat flour, potato starch and mustard, each mixed with corn flour; wheat flour containing potato starch; white pepper adulterated with ginger and with rice starch; and gentian root with added cocoanut shell.

This suggests the applicability of a similar method to the examination of milling and metallurgical products.

## Personals

**Herbert I. Ellis** is at Kellogg, Idaho.

**G. R. De Beque** is at Frawley, Colo.

**Walter Neal** has changed his address from Hall, Mont., to 1553 Haward Ave., Salt Lake City.

**J. R. Finlay** has gone to Arizona on professional business, expecting to be absent about three weeks.

**H. C. Bellinger** has been appointed general manager at Chuquicamata for the Chile Exploration Co.

**S. B. Williamson** will have charge of construction for the Chile Exploration Co. at Chuquicamata, Chile.

**F. R. Weekes** has returned to New York from a trip to British Columbia and California on examination work.

**I. L. Merrill**, of Los Angeles, Calif., president of the Hedley Gold Mining Co., has been visiting the Nickel Plate mine at Hedley.

**W. H. Wright**, of the Malm-Wolf Co., Denver, examined mining property near Silver Plume, Colo., last week.

**W. A. Williams**, superintendent of Granby smeltery at Grand Forks, spent a few days in the Nicola Valley looking at mining properties.

**Frank G. Berton**, gold recorder of the Yukon Territory, has resigned his position to enlist for service overseas with the Canadian Engineer corps.

**George N. Short** has been placed in charge of the new office of the Grasselli Chemical Co., recently opened at 1108 Newhouse Bldg., Salt Lake City.

**George L. Holmes**, consulting engineer, of San Francisco, is making a map of the Angels Camp district, California, for the Angels Camp Deep Mining Co.

**Henry Hay**, assistant general manager for the Chile Exploration Co., at Chuqunamata, was so badly injured while in an ore bin that one leg had to be amputated.

**Col. Thomas Cantley**, president of the Nova Scotia Steel and Coal Co., has gone to England in connection with important new developments in the plans of the company.

**Frank G. Stevens**, a graduate of the Kingston School of Mines, who has had a lengthy experience in Mexico and British Columbia, has been appointed managing engineer of the Davidson mine, Porcupine.

**Charles E. Mills**, general manager of the Inspiration Copper Co., has been made president of the Cananea Consolidated Copper Co. to succeed Dr. L. D. Ricketts, who will maintain his office in New York in the future.

**Reginald W. Petre**, mining engineer of Baltimore, has just completed an examination of the Newray mine on behalf of American capitalists and is investigating the mining conditions and methods of treatment of the ores of the Porcupine camp.

**W. Earl Greenough**, for 5 years manager of the Marsh Mining Co., Cœur d'Alene district, Idaho, resigned his position with that company on Oct. 1 to engage in independent practice, and has opened offices in the Old National Bank Building, Spokane, Wash. He will be assisted by S. B. Davis, formerly of Wallace, Idaho.

**Dr. John Sharshall Grasty**, formerly associate professor of geology at the University of Virginia, has resigned to take charge of the new department of mining geology recently established at Washington and Lee University. Dr. Albert William Giles has been appointed adjunct professor of geology in the University of Virginia.

**R. P. Burgan**, of Duluth, president of the Cananea Mining Co., the Carnegie Lead and Zinc corporations holding company in Mexico; C. J. Zachnane, treasurer, and directors D. T. Helm, A. W. Schruber, J. E. Cooley, V. Pridert, J. L. Crawford, S. W. Semman and W. J. Burgan visited and inspected the property at Cananea, Sonora, this week.

## Obituary

**Hon. David MacKeen**, lieutenant governor of Nova Scotia, died at his summer residence, Maplewood, N. S., on the 13th inst. as the result of a paralytic stroke at the age of seventy-seven. He took a prominent part in the development of the coal and steel industries of Nova Scotia. He was born at Mabou, N. S., and was the son of Hon. William MacKeen, a member of the Provincial Legislative Council. Entering the service of the Caledonia Coal and Railway Co. early in life he acquired a thorough knowledge of the coal-mining industry and became agent and treasurer of the company and ultimately its principal owner. The company was absorbed by the Dominion Coal Co. in 1893 and Mr. MacKeen was appointed general manager, resigning that position in 1896. He was also largely interested in the Dominion Iron and Steel Co., which he assisted in establishing. He was a director of the Dominion Steel Corporation and of several financial companies. In 1887 Mr. MacKeen was elected to the Canadian House of Commons in the Conservative interest as member for Cape Breton County and in 1896 was appointed a senator. He became lieutenant governor of Nova Scotia in October, 1915. A widow and four children survive him.

## Societies

**Society of Chemical Industry**—The next meeting of the New York section will be held at Runford Hall, 50 East 41st St., New York, on Friday evening, Nov. 24. The program will include an address on "The Importance of Impurities," by Jerome Alexander, the chairman, and one on "Some Present-Day Technochemical Problems," by R. F. Bacon, of the Mellon Institute.

**American Institute of Mining Engineers**—New York section will hold its first meeting of the fall season on Nov. 27, at the Machinery Club. At this meeting Edgar Rickard, who was one of the honorary secretaries of the Commission for Relief in Belgium at the headquarters in London for two years and who is now assistant director in America, will tell us about the work of American engineers in Belgium. Ladies are invited to attend this meeting.

**American Institute of Mining Engineers, Utah Section**—The postponed annual meeting of the Utah Section of the American Institute of Mining Engineers has been arranged to take place in Salt Lake City on Saturday, Dec. 16, 1916. At a later date a notice will be mailed to all members giving further particulars of the December meeting, including a list of papers to be read. C. W. Stimpson has been appointed to arrange for entertainment, and arrangements for the use of the inclosed roof garden at the Hotel Utah for the evening have also been made. C. W. Whitley, chairman, is arranging for two papers to be read that will be on live issues, and of vital interest. Ernest Gayford is secretary of the Utah local section.

## Trade Catalogs

**"Clipper" Rock Drills.** The Denver Rock Drill Manufacturing Co., Denver, Colo. Pp. 16. 6x9 in. Illustrated.

**"Spraco" Paint Gun.** Spray Engineering Co., 93 Federal St., Boston, Mass. Booklet. Pp. 13. 3½x6 in. Illustrated.

**"Churn-Drill Prospecting at Morenci, Ariz."** Armstrong Manufacturing Co., Waterloo, Iowa. Bulletin No. C. D. 2. Pp. 16. 6x9 in. Illustrated. This is a reprint of an article by Wm. R. Grunow, which appeared in the June 3d issue of the "Journal."

## New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

**Agitating Machine.** Willett H. Barton, Sam Diego, Calif. (U. S. No. 1,204,733; Nov. 14, 1916.)

**Alloy**—Metal Alloy Containing Metals of Nickel Group. Theodore B. Brix, Newark, N. J., assignor, by mesne assignments, to American Alloys Co., Newark, N. J. (U. S. Nos. 1,203,180 and 1,203,555; Oct. 31, 1916.)

**Alloy** of Lead, Antimony and Phosphorus. John T. Dwyer St. Louis, Mo. (U. S. No. 1,203,991; Nov. 7, 1916.)

**Crushing**—Tube Mill. Johan S. Fasting, Frederiksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y. (U. S. No. 1,204,554; Nov. 14, 1916.)

**Dehydrater.** Cyrus Robinson, Mount Vernon, N. Y., assignor to Metallurgical Engineering and Process Corporation. (U. S. No. 1,204,070; Nov. 7, 1916.)

**Drill**—Rock Drill. William A. Smith, Denver, Colo., assignor to the Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,204,708; Nov. 14, 1916.)

**Electric-Arc Furnace.** Carl Olaf Andersen Dovle, Notodden, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. (U. S. No. 1,204,349; Nov. 7, 1916.)

**Electric Furnace.** Ernest Kilburn Scott, Belvedere, England, assignor to Atmospheric Nitrates (Kilburn Scott Patents), Ltd., Manchester, England. (U. S. No. 1,203,276; Oct. 31, 1916.)

**Electrolysis**—Apparatus for the Electrolytic Manufacture of Light Metals and Reaction Products Thereof. Edgar Arthur Ashcroft, London, England. (U. S. No. 1,204,234; Nov. 7, 1916.)

**Flotation**—Concentration of Ores. Fleury James Lyster, Broken Hill, N. S. W., assignor, by mesne assignments to Minerals Separation American Syndicate (1913), Ltd., London, England. (U. S. Nos. 1,203,373, 1,203,374 and 1,203,375; Oct. 31, 1916.)

**Fuel**—Pulverized-Coal-Feeding Apparatus. La Rue B. Chevalier, Iola, Kan. (U. S. 1,203,703; Nov. 7, 1916.)

**Gases**—Means for Producing Discharge of Electricity Into Gases. Walter August Schmidt, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,204,907; Nov. 14, 1916.)

**Gases**—Method and Means for Recovering Certain Constituents from Gaseous Bodies. Walter August Schmidt, Los Angeles, Calif., and Linn Bradley, East Orange, N. J., assignors to Research Corporation, New York, N. Y. (U. S. No. 1,204,906; Nov. 14, 1916.)

**Ingot Mold.** Charles W. Greene, Pittsburgh, Penn.; Helen Greene, administratrix of said Charles W. Greene, deceased. (U. S. No. 1,204,270; Nov. 7, 1916.)

**Leaching**—Chemical Concentration of Ore Values. Charles S. Bradley, New York, N. Y. (U. S. No. 1,204,932; Nov. 14, 1916.)

**Loading and Conveying Apparatus** for Use in Mines. Robert P. Greenleaf, Cleveland, Ohio, assignor to Frank Billings, Cleveland, Ohio. (U. S. No. 1,204,760; Nov. 14, 1916.)

**Locomotive**—Electric Locomotive. John H. Flory, Columbus, Ohio, assignor to Jeffrey Manufacturing Co., Columbus, Ohio. (U. S. No. 1,203,999; Nov. 7, 1916.)

**Mine-Car Body.** Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,203,801; Nov. 7, 1916.)

**Mine-Car Wheel.** Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,203,800; Nov. 7, 1916.)

**Percussive Tools**—Water-Head for Fluid-Operated Percussive Tools. Lewis C. Bayles and Albert H. Taylor, Easton, Penn., assignors to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,201,676; Oct. 17, 1916.)

**Phosphate Rock**—Treatment of Phosphate Rock. Earl S. Bishop, Pittsburgh, Penn., assignor to Armour Fertilizer Works, Chicago, Ill. (U. S. No. 1,204,238; Nov. 7, 1916.)

**Refining**—Process for Treating Copper. Frank L. Antisell, Perth Amboy, N. J. (U. S. Nos. 1,204,926 and 1,204,927; Nov. 14, 1916.)

**Refractory**—Silicon-Carbid Refractory Article. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Co., Niagara Falls, N. Y. (U. S. No. 1,204,211; Nov. 7, 1916.)

**Refractory Materials.** Process for Making. Charles B. Stowe, Lakewood, Ohio. (U. S. No. 1,205,056; Nov. 14, 1916.)

**Tin**—Detinning Tin Scrap. Walter J. Phelps, Baltimore, Md., assignor to Phelps Can Co., Weirton, W. Va. (U. S. No. 1,202,886; Oct. 31, 1916.)

**Titanic Oxide**—Method of Obtaining Titanic Oxide. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,201,541; Oct. 17, 1916.)

**Wire Rope**—Nonrotating Wire Rope. Noble C. Harrison, Trenton, N. J., assignor to John A. Roebling's Sons Co. (U. S. No. 1,201,290; Oct. 17, 1916.)

## Assessments

| Company | Delinq. | Sale | Amt. |
|---|---|---|---|
| Buffalo, Ida. | Nov. 15 | Dec. 12 | $0.005 |
| Challenge, Nev. | Nov. 29 | Dec. 20 | 0.05 |
| Christmas, Utah | Nov. 20 | Dec. 16 | 0.005 |
| Confidence Silver, Nev. | Nov. 8 | Nov. 29 | 0.10 |
| Con. Virginia, Nev. | Dec. 8 | Dec 29 | 0.05 |
| Cottonwood King, Utah | Nov. 14 | Dec. 1 | 0.005 |
| Cunapah, Utah | Nov. 8 | Nov. 25 | 0.01 |
| Emerald, Utah | Nov. 15 | Dec. 9 | 0.004 |
| Exchequer, Nev. | Dec. 5 | Dec. 27 | 0.03 |
| Federal Ely, Nev. | Dec. 2 | Dec. 20 | 0.005 |
| Four Timbers, Ida. | Dec. 2 | Jan. 2 | 0.002 |
| Friend, Ida. | Oct. 21 | Nov. 24 | 0.002 |
| Hale and Norcross, Nev. | Nov. 8 | Nov. 29 | 0.03 |
| Idaho & L. A., Ida. | Oct. 16 | Nov. 17 | 0.005 |
| Idaho Mont, Ida. | Oct. 30 | Nov. 18 | 0.002 |
| Idaho-Nevada, Idaho. | Nov. 15 | Dec. 16 | 0.002 |
| Idora, Ida. | Nov. 24 | Dec. 23 | 0.005 |
| Lehi Tintic, Utah | Nov. 8 | Dec. 2 | 0.0025 |
| LeRoy, Ida. | Oct. 28 | Nov. 28 | 0.005 |
| Lion Gold, Utah | Nov. 13 | Dec. 5 | 0.0025 |
| Mary Ellen, Utah | Nov. 11 | Nov. 28 | 0.001 |
| Mexican G. & S., Nev. | Nov. 25 | Dec. 18 | 0.10 |
| Military, Ida. | Oct. 25 | Nov. 25 | 0.00025 |
| Mines Dev., Utah | Nov. 17 | Dec. 7 | 0.30 |
| Monarch-Pgh., Nev. | Oct. 23 | Nov. 27 | 0.01 |
| Naildriver, Utah | Nov. 4 | Dec. 4 | 0.01 |
| National Lead, Ida. | Nov. 25 | Dec. 26 | 0.001 |
| Nevada-Stewart, Ida. | Nov. 14 | Dec. 2 | 0.002 |
| New Hope, Ida. | Oct. 11 | Dec. 11 | 0.002 |
| Nonpareil, Ida. | Oct. 23 | Nov. 23 | 0.001 |
| North Franklin, Ida. | June 19 | Nov. 23 | 0.005 |
| North Star, Ida. | Oct. 10 | Dec. 5 | 0.001 |
| Paloma, Utah | | | 0.015 |
| Pittsburgh Cons., Utah | Nov. 17 | Dec. 8 | 0.0175 |
| Rico-Argentine, Colo. | Nov. 18 | Dec. 5 | 0.01 |
| Seg. Belcher & Midas, Nev. | Oct. 30 | Nov. 24 | 0.02 |
| Selma, Utah | Nov. 4 | Nov. 23 | 0.005 |
| Silver Moon, Ida. | Nov. 25 | Dec. 23 | 0.005 |
| Silver Mt., Ida. | Oct. 21 | Nov. 24 | 0.002 |
| Sonora, Ida. | Nov. 15 | Dec. 6 | 0.004 |
| Tobar, Nev. | Nov. 2 | Nov. 23 | 0.002 |
| United Tintic, Utah | Nov. 11 | Nov. 28 | 0.005 |
| Utah Arizona, Ariz. | Oct. 31 | Nov. 25 | 0.005 |
| Utah United, Utah | Nov. 15 | Dec. 4 | 0.01 |
| Wallace M., M. & R., Ida. | Dec. 8 | Jan. 8 | 0.0025 |
| Zuma, Utah | Oct. 30 | Nov. 30 | 0.005 |

The publication of this table will be discontinued after Dec. 30, 1916.

# Editorial Correspondence

### SAN FRANCISCO—Nov. 15

**Miners in Amador County Are Returning** to work, following the ending of the labor strike. Many left the county as soon as the strike was declared, as they were not engaged in the demand for increased pay. Some of the foreigners who voted for and conducted the strike, but declined to favor the return to work, have now left the county. It is believed all the mines will be working full handed within another month.

**The Blue Sky Law in California** has been in operation since Jan. 1, 1915, and the commissioner of corporations has filed what he calls his first biennial report, covering 20 months to Sept. 1, 1916. The commissioner offers the assurance that "the operation of the Investment Companies Act has clearly demonstrated the expediency of its passage and necessity of its continuance." Evidently the purpose of filing this report on Oct. 28, 2 months prior to the close of the biennial period, was to acquaint the voters of the state with the performances of the commissioner and to encourage supporters of the administration at the polls. Nobody questions that the department of corporations has accomplished a great deal of good; neither is there any question that a good deal of hardship has been worked upon a number of small operators, especially in the mining field. Other departments created or reorganized by the Johnson administration have likewise accomplished some benefit to the people, but some of them have become so expensive that they may be classed as luxuries. An utterly useless department or bureau could not survive, so it is necessary to accomplish some good in order to be maintained. The department of corporations supplies the press of the state with regular reports of the doings of the department. Some of these items regarding the mining industry are of value for publication, but many of them are incomplete and wholly useless. In the 20 months covered by the report, the commissioner has authorized the issue by 1,970 corporations of an aggregate of 82,781,439 shares of stock at an authorized aggregate selling price of $246,353,759, and the sale by 93 companies of bonds of a total face value of $59,699,400. Approximately 120 companies, having an aggregate authorized capital stock of $53,000,000, and proposing to sell $23,000,000 of their securities, were either denied authority or they abandoned their application, because of failing to furnish necessary information or to comply with required conditions. There were 304 permits issued that were subsequently revoked. Some of these revocations were due to the completion of the financing of the corporation and withdrawal of the securities from the market; others because the business was being conducted in a manner perilous to the interests of investors. No appeals from the rulings of the commissioner have been taken to the courts. It is pointed out that 312 mining and oil companies have been permitted to offer more than $78,000,000 of their securities for sale. The expense of maintaining the department was $57,755 for the 20 months.

### DENVER—Nov. 16

**Modoc Mine at Victor,** in the Cripple Creek district, has passed to new ownership. Since 1892 this mine has been owned and operated by a close corporation, consisting of members of the Frankenburg family, of Pueblo. It was recently purchased by a group of Denver men, incorporated as the Modoc Consolidated Mines Co. with James Grafton Rogers, an attorney, as president. This mine's production has always been kept secret. It was famous 20 years or more ago for its rich shipments, one carload lot shipped to Pueblo being reported as worth $40,000. Sinking the main shaft a further depth of 500 ft. from the 1,000 level is proposed.

**Coal Miners' Wages Advanced** in the northern Colorado coal field, particularly in Boulder County, on Nov. 16. All company men, paid by the day, will receive 5% more than heretofore, while miners working on contract will receive an additional 3c. per ton. Under this new schedule, outside men with the exception of hoisting engineers will receive $2.94 per 8 hr., while these engineers will be paid $3.46½ per shift. Contractors will receive 66c. per ton for coal broken and loaded into cars. These prices and wages are slightly higher than those prevailing in the bituminous fields of the southern part of the state. Throughout Colorado, advances have been made in the prices for coal to dealers and consumers, varying from 50c. per ton for lignite to $1 per ton for anthracite.

**Colorado Power Co.'s Tunnel** and power plant at Shoshone, a few miles above Glenwood Springs, were seriously damaged during the night of Nov. 7 by an incipient earthquake or fault. This wrecked part of the tunnel paralleling the Grand River and conveying water from the dam to the power house 2 mi. downstream. The tunnel was driven through solid rock the entire distance and finished with a thick concrete lining. The company supplies power to many mining companies throughout central Colorado and to the Denver public utilities. Some inconvenience is being experienced because of this seemingly improbable phenomenon but power is being supplied at maximum capacities from the company's hydro-electric plant at Magnolia, in Boulder County, and its steam plant at Leadville, as well as from the Denver Gas and Electric Co.'s steam plant in Denver. A big force of men is employed making such repairs at Shoshone as are expected to enable the plant to resume within the next two weeks. By way of preparedness, the Denver company has ordered a 12,500-kw. steam turbine to be installed in its West Side station.

**Empire Zinc Co.** is carrying on extensive work at Leadville, principally in the nature of unwatering, reopening and repairing old mines on Carbonate Hill. At the Robert Emmet mine, Superintendent Bargler is repairing the main shaft and enlarging the main drifts therefrom, this mine having been completely drained by the pumping operations in the neighboring Wolftone and Greenback mines which, though not owned or controlled by the Empire company, have been coöperating in the recent drainage project. The Emmet workings could now be carried several hundred feet deeper, it is claimed, without encountering water. New drifts are being pushed in the McCormick to intercept known orebodies and old drifts are being enlarged and retimbered. Although no effort has thus far been made to ship any specially heavy tonnage, shipments are being maintained and every arrangement is being provided to assure a large production in the near future. A new railroad spur is being laid to the McCormick shafthouse.

### LEADVILLE, COLO.—Nov. 16

**Leadville's Ore Production** continues to grow steadily, due to the entrance of the Penrose, Tip Top, Cloud City and other properties into the shipping list. During October, 80,600 tons of ore of various grades and widely differing content were sent to the smelters. The 100,000-ton mark is expected to be reached when the Empire Zinc Co., the Mikado and the Greenback begin shipments.

**Copper-Ore Shipments from Leadville** are forming part of the regular output of the Little Jonny and other mines on Breece Hill, controlled by the Ibex Mining Co. Several hundred tons of copper ore, carrying from 6 to 14% copper, are being shipped monthly. Some large specimens of native copper have been extracted. Indications point to more copper shipments, owing to the high copper market.

### BUTTE—Nov. 16

**More Water Power for Montana Mines** will soon be available. Just now attention is being directed to the Montana Power Co.'s latest project, known as the Wolf Creek plant, situated on the Missouri River, 60 mi. above Great Falls. Its cost is estimated at $3,500,000, and when completed it will furnish approximately 66,000 hp. Power is expected to be available by next July. The new plant will materially help in the development of Montana's mineral resources and other industries awaiting the advent of cheap power.

**Anaconda Operations Were Closed** for a day or two by the sudden advent of winter at the beginning of the week, with temperatures ranging between —10° and —20°. Operations at Butte, Anaconda and Great Falls were unprepared to cope with the effects of such a violent temperature drop. As a result the Anaconda Copper Mining Co. and other concerns were forced to close most of the Butte mines for periods of from 24 to 36 hr., the ore in the bins freezing too hard to be successfully handled. Altogether, more than 10,000 men were affected by the weather conditions, losing from two to three shifts a man, while the loss to the companies will amount to many thousands of dollars. Not for 13 years was Butte and vicinity visited by so early zero weather, which accounts for the fact that the thawing rooms were not in readiness, nor extra supply of ores on hand for such an emergency. Stoppage of operations will curtail monthly output about 1,500,000 lb. Work was resumed on Wednesday at most of the mines and works.

### SALT LAKE CITY—Nov. 16

**A Six Weeks' Course in Mining** for prospectors, miners and business men is proposed by the University of Utah for the coming winter. The course will offer instruction in the fundamentals of mining, as well as some of the theory underlying mining practice.

**Net Proceeds of Utah Mines for 1916**—as figured by the state board of equalization—will amount to $21,825,609. In 1915 net proceeds were $8,119,195 and in 1914 these were $9,663,186. Figures by the board show the output of the year as coming from 12 counties, with Salt Lake County in the lead, Summit County second, Carbon County third and Juab County fourth.

**Tintic Shipments** in nine months ended Sept. 30 amounted to approximately 365,450 tons of ore. Few districts in the country have as many producers and dividend payers. From present outlook Tintic output for 1916 will be heaviest in history. Principal shippers are: Chief Consolidated, Dragon Consolidated, Iron Blossom, Centennial-Eureka, Eagle & Blue Bell, Mammoth, Gemini, and Grand Central. Altogether 50 mines made shipments.

**Utah Power and Light Co.,** which furnishes electricity to mining and smelting interests in this section, is increasing its capitalization from $45,000,000 to $60,000,000, according to a notice filed Nov. 6 with the secretary of state. Extensive development already accomplished and plans for future expansion are responsible for the increase. Extensions will be made to furnish power for railroads. The company has in view electrification of the road to Saltair and of the Bingham & Garfield Ry. Further use of electricity at the Utah Copper mine is being considered.

**Daly-Judge Co.,** of Park City, has now completely given way to the Judge Mining and Smelting Co. Shares of the new company were listed on the Salt Lake Stock and Mining Exchange, Nov. 11, in place of the former Daly-Judge. The official statement filed at the time of listing shows that there are 500,000 shares of $1 par value. There are 20,000 shares in the treasury and $825,000 cash. The only debts are current expenses. The company owns 150 patented claims amounting to about 2,000 acres, about 1½ mi. from a railroad and situated in the Snake Creek district, Uinta County and Big Cottonwood. Development consists of 1,650 ft. of shaft and 30 mi. of underground workings. The property is equipped with modern electric hoist, a 450-ton concentrator, and has an electrolytic-zinc plant nearing completion. The capacity of this plant will be 15 tons of spelter per day. Shipments average about 500 tons a week, of ore carrying silver, lead, zinc, gold and copper. There are 350 men employed. H. Otto Hanke is president, and G. W. Lambourne, secretary-treasurer.

### SPOKANE—Nov. 14

**The Day Holdings in Hercules Mine** have lately been increased through the purchase by Mrs. Eleanor Day Boyce, of Portland, Ore., of the sixteenth interest in the property formerly held by the estate of the late Damian Cardoner, of Barcelona, Spain. With the exception of August Paulsen, of Spokane, Mrs. Boyce becomes the largest individual owner in the Hercules mine, her interest now being slightly less than one-quarter, while the Paulsen interest is a fraction over one-quarter. The aggregate interests of the Days in the Hercules mine now amount to $^{33}/_{64}$, or slightly more than a half interest. The consideration named in the recent deed, which bears date of Oct. 28, is $1, but it is believed that the price actually paid for this controlling fraction was $500,000. The $^{1}/_{16}$ interest conveyed by deed is the interest left in the estate of Cardoner and was appraised in probate court at $250,000. This interest was distributed to Mathilde Cardoner, widow, and the deed is made by her to Mrs. Boyce. Other Day holdings are reported to be $^{3}/_{32}$ each for Harry L., Jerome J. and Eugene R. Day, while Blanche Day Ellis, a sister, holds $^{1}/_{64}$ interest.

### PHŒNIX, ARIZ.—Nov. 15

**Jerome Verde Contact Copper Co.** is ordered by State Corporation Commission to refund all money collected for pre-organization stock; also to report all stock sales and copies of letters soliciting same. In one week 20 mining companies filed articles of incorporation and 10 investment companies were given permits to sell stock.

### MORENCI, ARIZ.—Nov. 16

**Work Resumed at Arizona Copper Co.'s** properties on Nov. 15 by striking employees. After losing 11 days' work, pulling switches, letting the company's concentrator and smeltery close, beating up a couple of men, and running them out of town, the strikers decided it was not a good business policy to forfeit five or six thousand dollars a day in an effort to collect $45, which latter is the sum Juan, or José, was demanding for the time he was laid off. Just how the agreement was brought about has not been learned. Mr. Myers, of the department of labor, has been in Clifton the last few days, and it is possible he had something to do with the conciliation. On the night of Nov. 12 the company's concentrator had a narrow escape from destruction by fire of an incendiary origin.

### MOGOLLON, N. M.—Nov. 14

**A Drainage and Transportation Tunnel,** on Mineral Creek, which will eventually tap the leading vein systems of the camp at various depths up to 1,800 ft., is about to be started by the Oaks Co. The road to the tunnel site has been overhauled to facilitate traffic to that point. The road through Mogollon is also being macadamized and put in shape for winter traffic, though this has no connection with the drainage-tunnel project.

**Pacific Mine's Aërial Tramway** to the Socorro mill, 1 mi. distant, has just been completed, tested and found to operate perfectly. The adoption and placing in commission of this system of transporting the Pacific product marks the end of an era of operation during which 11,162 tons of ore carrying a gross value of $171,585 were mined in a crude way and shipped to local custom mills by burro train. While the general average of ore mined in the Mogollon district for the period has been around $12 per ton, that from the Pacific had an average of $15.37, and with the more adequate mining facilities now employed, in connection with modern tramway delivery to mill, the property may be expected to soon eclipse its past record and take rank with the best producers in the camp. Operations at the Pacific mine are being conducted by Socorro Mining and Milling Co., under agreement with the Oaks Co.

### JOPLIN—Nov. 18

**Settlement of Henryetta Labor Troubles** is reported. The trouble at the Oklahoma smelteries was caused when announcement of a cut in wages was made. Workers decided to strike rather than accept cut, and did so. Then price of spelter went up and smelters decided they could afford to pay the bonus and offered to do so and employees went back to work. During the past week gas-fired smelteries suffered from weak-gas pressure, and a slightly decreased demand from them for zinc ore was recorded as result. Work is being pushed on construction operations of C. T. Orr smeltery, to be known as the Athletic, at Fort Smith, Ark. City is laying temporary pipe line to site to furnish water for building purposes, permanent main to be laid later.

**Continued Curtailed Output** during the past week must be reported from this district, due to insufficient electric current and to weak gas pressure. The later was caused by the unseasonably severe cold wave the first of the week, creating an unexpected demand for gas for heating purposes. At a number of properties where gas is depended upon entirely for fuel, it was necessary to shut down for a day, and at some places for two days. The electric company is still unable to meet the demands for current, as recent rains have not been sufficient to raise the water in Spring River, nor at the Lake Taneycomo dam, so full service from water-operated turbines can be received. Most of the electrically operated mills are permitted to run only at night, and as most of them would, with present prices, be operating night and day, it means a considerable curtailment in the ore output.

### HOUGHTON, MICH.—Nov. 15

**Labor Situation** in the Lake Superior district has cleared itself in a remarkable manner. The number of men employed increases steadily now that winter is ahead and the men are doing more work. That applies particularly to contract mining and tramming, where the pay is remarkably high. Ten years ago there was a plan on foot to do away entirely with contract mining—the old Cornish mining system that came to the Lake Superior district with the first copper miners. Some of the mines applied nothing but the plain day-wage system to all miners. But in recent years more and more of the mines have changed back to the contract system. When the Calumet & Hecla took over the Fay mines and the Bigelow mines it instituted the contract system, always popular in the Calumet & Hecla. And it has resulted in greater efficiency. At the present time the men are making extremely high wages. Miners that are able to get better than $200 a month are not so exceptional as formerly. This is not the average, of course, but there is hardly a contract miner in the district who is not averaging better than $5 a shift at present. Of course the contract men are the best men. And they work all the time and know their business. They are the pick of the miners. Contract tramming, at first laughed at as a joke, is becoming more and more in vogue. And it is resulting in a much larger haulage than was ever considered possible. Not only that, but the men are making a great deal more money than was possible on the flat scale. One gang of trammers averaged $4.85 per shift per man last month. Combining the greater efficiency of the men, the application of brains as well as strong backs to tramming, with the steadily increasing number of underground employees, the mines are likely to surpass their best records for rock and copper outputs in November and December.

### WASHINGTON, D. C.—Nov. 20

**Reduction in Mexican Taxes** on mines is reported unofficially in an interview with Luis Cabrera, acting in his capacity as secretary of the treasury for the Carranza government. He is quoted as saying that "tax on mined gold and silver ore will be reduced from 10% to 7% and on bullion from 8% to 5%." A schedule of taxes acceptable to the foreign mining companies has been prepared and submitted to Señor Cabrera, who is anxious to provide conditions that will restore the mining industry to its former activity.

### TORONTO—Nov. 18

**Sudbury Nickel on "Deutschland"** is the claim of the Providence "Journal." Members of both the Federal and Provincial governments are disposed to be extremely reticent as to that paper's statement that the nickel which forms a portion of the return cargo of the "Deutschland" is the product of the Sudbury mines. Beyond a repetition of the assertion that the precautions taken with the approval of the British government render it impossible for Canadian nickel to fall into German hands, they have nothing to say on the matter. The Ottawa government has ordered an investigation. It is stated that no official statement on the matter can be made without the sanction of the British government.

**Returns of Metalliferous Mines and Works** of the Province of Ontario for the nine months ended Sept. 30 are interesting for the comparison with the preceding year's value. The nine months of 1916 showed an output of a total value of $46,396,263 as compared with $26,751,288 for the corresponding period of the previous year. This increase is more apparent than real as it is partly made up by putting a value of 25c. a lb. on nickel in matte instead of 11c. as formerly. Had the same price been applied to 1915, the total for that period would have been $34,228,752. The real increase is however gratifying, and the returns for the full year should be proportionately greater, as many of the mines have been increasing their capacity. Cobalt and nickel, both oxides and metallic, show considerable increases but do not represent any large proportion of the total values. Copper shows an increase of about $4,000,000 in value and gold shows an increase of about $2,000,000. Nickel due partly to a natural increase in production and partly to the new basis of valuation shows an increase from $5,370,000 to $15,500,000. While the production of silver shows a decrease of about 1,000,000 oz., the value due to higher prices shows an increase of $1,750,000.

# The Mining News

## ALASKA

ALASKA MEXICAN (Treadwell)—In September, mill ran 17 days; crushed 10,780 tons, yielding $16,380, or $1.53 per ton; operating expenses, $12,260; operating profit, $4,119; construction, $3,109; net profit, $1,009; estimated net value, $26,034.

ALASKA UNITED (Treadwell)—In September, both mills ran practically full time, Ready Bullion mill crushed 23,394 tons, 700-Ft. Claim mill 24,675, average yield, $1.70 and $1.90 per ton respectively; net realization, $39,346 and $46,334; operating expenses, $35,975 and $63,336. Ready Bullion operating profit, $3,370; construction expense, $15,710; net loss, $12,339. Operating expense, 700-Ft. Claim mill, $63,336; loss, $17,002; construction, $5,919; net loss, $22,921.

ALASKA-JUNEAU (Juneau)—Good progress is being made with the new mill. There is neither a screen nor an elevator in it. There will be a minimum capacity of 8,000 tons, a probable capacity of 10,000 tons and a maximum capacity of 12,000 tons per day, all depending upon the output of the "ball mills." The management expects that the operating costs will be astonishingly low, consisting principally of tramming and milling, as the caving system laid out is already so successfully working that the mine is about ready to supply the mill to its maximum capacity. The mill building proper is now all under cover and about half of the interior machinery has been delivered. It is expected that the first unit of the mill will be ready by next March.

ALASKA-TREADWELL (Treadwell)—The proposed consolidation is now up to the stockholders, who are scattered in large numbers all over Europe. It is going to require considerable time to work the matter out, for the consent of 51% of the Treadwell stockholders has to be obtained to begin with; in the meanwhile, the management is going right ahead doing everything that should be done for the common good on the consolidation ratio of 54, 34 and 12%, as recommended by the consolidation committee. In September, 150 stamps were operated, crushing 24,794 tons, averaging $2.19 per ton—$13,154 in free gold and $41,095 in concentrates; net realization, $53,706; operating expenses, $31,139; construction, $11,780; net operating profit, $10,786; estimated net value copper plates, $42,289; other income, $11,281.

## ARIZONA

### Gila County

MEMBERS BRADEN MILL STAFF, including Supt. Horace Graham and Messrs. Rutherford, Rain and Moran have been in Miami studying milling operations of Inspiration and Miami companies.

### Greenlee County

SHANNON (Clifton)—October copper production about 757,000 lb.

ARIZONA COPPER (Clifton)—October production, 2,450 short tons of copper.

### Mohave County

IVANHOE (Oatman)—Unwatering; will resume operations on 500-ft. level soon.

OATMAN UNITED (Oatman)—Working shaft 150 ft. deep. New compressor now in use.

UNITED NORTHERN (Oatman)—Wide vein, carrying fair gold content, cut on 400-ft. level.

OATMAN CRESCENT (Oatman)—Main adit now in about 500 ft. Manager George Pierce expects to cut vein in few days.

CARTER (Oatman)—Chicago men will take block of 350,000 shares for $68,687. Fund to be applied to development of property and small mill may be erected.

BIG JIM (Oatman)—Complete sampling shows higher average value than previously conceded. Sampled at every 5 ft. on 515 ft. of drifts; said to average $22.80 per ton.

### Pinal County

MAGMA (Superior)—Report for third quarter states: Produced 2,153,364 lb. copper at cost of 9.95c.; average selling price, 24.55c.; average monthly profit, $104,808. Production in preceding quarter, 2,232,936 lb.; monthly profit, $101,675.

### Yuma County

ARIZONA EMPIRE MINES (Parker)—Considering plans for flotation plant; 1,000-ft. shaft will be started soon; contract let for hauling 2 cars ore daily to Parker.

YUMA WARRIOR (Salome)—Shipping gold bullion from oxidized ore mined in upper levels of old Harqua Hala Bonanza mine; plan to develop sulphide ore in lower levels.

## CALIFORNIA

### Calaveras County

ESTELLE GOLD MINING CO. (Angels Camp)—New incorporation, capital $150,000; property situated on West Belt of Mother Lode. Installing Straub 10-stamp circular mill. Dr. Estelle Sibald, of Denver, interested.

ANGELS MOHAWK MINING CO. (Angels Camp)—New five-stamp mill installed to treat ores from the Sultana, Maltman and Great Western; additonal five stamps contemplated. Doctor Galleri and associates interested.

PURE QUILL (Angels Camp)—Fred Bender has bonded, unwatered shaft, installed new headframe and hoist. Will drive a crosscut at 100 level and sink. Good ore exposed in crosscut at 50-ft. level. Small mill contemplated.

ANGELS CAMP DEEP MINING CO. (Angels Camp)—New air compressor installed. Concrete foundatons placed under hoist and mill. Sinking resumed with air drills. Shaft, now down 125 ft. on Pioneer claim, to be deepened to strike footwall at about 600 ft. total depth. Crosscut at 90-ft. level disclosed 12-ft. vein.

### Eldorado County

TEDDY BEAR (Placerville)—John W. Cover, and associates, of Seattle, exploring this property.

HOLLY QUARTZ MINING CO. (Placerville)—Incorporated for $50,000 to acquire the Lemon mine, situated on the edge of town. Louis Scholler, C. A. Doyle and George Corey are incorporators; principal office at Fresno.

BOSTON COPPER (Placerville)—Property, idle since Civil War, recently examined by John C. Skuse, mining engineer of the Champion copper mine at Luning, Nev., with view of determining if it will warrant development. Ore mined in early days was treated at property in small smeltery situated on the property.

### Inyo County

CERRO GORDO (Keeler)—The zinc-carbonate and silver-lead orebody disclosed last June on the 200 level and developed in October on the 300 level has been found to persist to the 550-ft. point, maintaining a width of 6 to 10 ft. The carbonate average is 45% zinc and the silver-lead ore car-

ries 35 oz. silver to the ton. Company has recently acquired additional claims north of the present working with the expectation of prosecuting development in that territory. Besides the ore being shipped, 50 tons per day of slag from the old smelting furnaces is also going out.

DARWIN LEAD AND SILVER MINES (Darwin)—Second unit of mill using Murex process for lead-carbonate ores will be completed early in 1917. Annual capacity of plant will then be 20,000 tons.

### Sierra County

MARIPOSA (Alleghany)—Stamp mill being installed. S. A. Hendricks in charge.

HOMESTAKE (Downieville)—Large vein carrying free gold uncovered. Under examination by San Francisco engineer. Cole Burke, owner.

OPHIR (Alleghany)—Rich ore struck in upper workings. Lower tunnel being driven to tap two oreshoots. S. A. Hendricks, superintendent.

SLATE CREEK (Port Wine)—Débris dam completed. Bedrock cuts being run, and repairs made to flumes and ditches, preparatory to hydraulicking. C. A. Brunnell in charge for Los Angeles company.

### Siskiyou County

WILLIAMS COPPER (Happy Camp)—Property at the head of Buzzard Creek reported bonded by J. B. Woods and associates, of San Francisco.

G. E. BRADLEY CO. (Happy Camp)—Road being constructed from Klamath to mine on Independence Creek, 12 mi., will be rushed to get supplies in before heavy snows come. Cyanide plant for testing ores will be installed in spring.

### Tuolumne County

BASIN (Columbia)—Deep gravel property being unwatered with electrically driven pumps.

CONFIDENCE (Sonora)—Headframe, blacksmith shop, cottages and other surface improvements installed preparatory to unwatering north shaft.

HARVARD (Jamestown)—Reported that mine will be reopened for development, and that H. W. Gould has resigned as manager to give all his attention to management of New Idria quicksilver mine in San Benito County.

## COLORADO

### Boulder County

WIND STORM in Caribou-Lakewood-Nederland district Nov. 10 caused much damage. Chief loss at Nederland where National Building and Widman Hotel were blown off foundations and many small buildings destroyed.

PYRAMID MINING, MILLING AND EXPLORATION CO. (Gold Hill)—Gold-silver oreshoot assaying over $200 per ton opened in tunnel at point 315 ft. from portal, and 700-ft. vertical depth.

DEGGE-CLARK (Boulder)—Storage facilities for crude ore and concentrates being increased at this custom tungsten mill in Boulder Cañon, permitting the holding indefinitely of tungsten ores pending changes in market price.

U. S. GOLD CORPORATION (Sugar Loaf)—New oreshoot opened on Douglas vein in Livingston mine. Considerable milling ore having average value of $20 a ton disclosed; rich streaks assay as high as 4 oz. gold a ton. Sinking pump being installed in fifth level; contract let to Allen McCarver to sink shaft to 600-ft. level.

### Clear Creek County

GOLD ANCHOR (Alice)—Payable ore being developed and mill is in operation.

CLARA (Alice)—Development will be resumed in near future by owner, Henry J. Walder.

JEAN (Empire)—Ore being shipped from this mine in Daly district to mill at Empire station.

OTTAWA (Alice)—A 20-in. streak of 2-oz. gold ore opened by John Kaminky. Another opening will be driven to develop vein at a lower level. Two products produced from development; first-class ore shipped to smelters and milling ore treated in the Argo mill at Idaho Springs.

CONSOLIDATED MINES DEVELOPMENT (Alice)—This company is developing the Yukon property. Three drifts on 130-ft. level are being advanced on ore. A three-compartment raise is being driven for development and ventilation. New change room and shop constructed at portal of tunnel, which has been advanced 575 ft. and will be continued to Silver Moon vein and thence to Gold Quartz vein, a total distance of about 500 ft. Installation of air compressor and machine drills under consideration. The Evening Star, at Argentine, acquired recently by company, is being explored.

### Gunnison County

VULCAN MINES CO. (Vulcan)—Has closed its mines and smelting plant indefinitely.

COLORADO-YULE MARBLE CO. (Marble)—At petition of Receiver J. F. Manning, court has ordered quarries and finishing plant closed after completion of present contracts and placed in hands of caretakers until final disposition made.

### Lake County

IRON-SILVER MINING (Leadville)—Mikado mine, on Carbonate Hill, is being equipped with a 300-hp. Wellman-Seaver-Morgan electric hoist—largest of its type in state.

### Ouray County

VERNON MINING CO. (Ironton)—Has encountered high-grade silver-copper ore in South Dakota vein, and is shipping copper ore from Vernon vein to Durango. Incline shaft on South Dakota vein, now 150 ft. deep, is being sunk to 500 ft. to tap intersection of Vernon and South Dakota veins; sinking 5 ft. per day with Jackhamer drills. Compressor, sawmill and winter supplies taken in. A. G. de Golyer, manager.

### Saguache County

MICHIGAN-PARAGON (Bonanza)—These two properties under lease to Warren F. Page and associates, of Leadville. Some good-grade copper ore shipped from Michigan. Paragon tunnel, lower working on two properties, being reopened so that both can be worked through it.

RAWLEY (Bonanza)—Driving three-compartment raise from main adit, or 1,200-ft. level, to 600-ft. level under way. Regular shipments 50 tons daily of heavy sulphide ore being made to Ohio & Colorado Smelting Co., Salida. Railroad shipping point, Villa Grove; ore hauled by teams and one truck. Surveys of tramway from adit portal to Denver & Rio Grande R.R. at Shirley station, tram terminal and ore bins completed. Excavating for power house and installation of electric power line under way. Stated options secured on several properties adjoining, among them Superior-Huron, Sastilla, Peyton and other groups. Work held back by scarcity of miners.

### San Miguel County

SHIPMENTS of concentrates from Telluride during October were as follows: Tomboy, 61 cars; Smuggler-Union, 51; Liberty Bell, 15; Black Bear, 1; total, 128 cars.

### Summit County

SHIPMENTS from Kokomo-Robinson district increasing. Among mines now shipping are Robinson Tunnel, Wilfley, Felicia Grace, Silver Bowl, Colonel Sellers, Raven-Eagle and Michigan.

TUCKER MOUNTAIN MINING (Kokomo)—Has leased Red Cloud and Black Cloud groups on Tucker Mountain. Will develop shoot of copper ore.

### Teller County

SHOO FLY (Cripple Creek)—Being developed by Hickman & Co., who have made a shipment.

BLUE FLAG GOLD MINING (Victor)—Bids being received for sinking Raven Hill shaft 300 ft. below present level of 1,100 ft.

AJAX (Victor)—Entire property on Battle Mountain, excepting the Colburn mill, have been purchased by Judge E. A. Colburn for $480,400.

GOLDEN CYCLE (Colorado Springs)—Recent sale of plant and property of United States Reduction and Refining Co., at Colorado City, to this company, confirmed by Federal court. Consideration $383,000, less certain credits. Final payment of $50,000 made to receiver Arthur Connell. Plant will be dismantled. Later: Entire plant purchased by Morse Bros. Machinery and Supply Co., of Denver.

ALBERT-BEACON (Cripple Creek)—Shipments of one car per day being made from Prince Albert shaft, on Beacon Hill. Electric hoist will be installed at old Beacon shaft and mine reopened. Shaft will be sunk from present depth of 360 ft. to cut Gold Dollar flat vein 300 ft. deeper. Subleases will probably be let on this mine. Some production being made from Iland tunnel.

## IDAHO

### Shoshone County

BUNKER HILL & SULLIVAN (Kellogg)—Satisfactory progress is being made with the smelting plant and it should be in operation by next May. The only difficulty so far has been the delivery of cement in sufficient quantities.

REX CONSOLIDATED (Wallace)—Purchased six claims adjoining Rex group in Nine Mile Cañon; reported price, $47,600 cash and 187,000 shares of Rex. Mill has been given trial run; capacity now about 200 tons. Reported that company has optioned Hypotheek ground near Kingston; equipped with 200-ton mill about 6 mi. from Cataldo station.

CONSOLIDATED INTERSTATE-CALLAHAN (Wallace)—Regarding increased rail facilities, report says: "Construction of the Oregon-Washington Railroad and Navigation Co.'s new branch line up Beaver creek will enable us to ship our ore all the way by rail to Enaville, Idaho, where the proposed new mill is to be erected. It also will make possible opening the property on the Beaver Creek side giving a depth of 3,000 ft., or 1,500 ft. lower than the No. 7 level."

## MICHIGAN

### Copper

LAKE (Lake Mine)—Sending 300 tons daily to the Baltic mill, same yielding about 26 lb. to the ton.

ISLE ROYALE (Houghton)—Has completed enlargement of No. 7 Shaft to full size, and begun sinking.

AHMEEK (Ahmeek)—Development of Kearsarge conglomerate discontinued in order to use men to get out ore; will be resumed later.

VICTORIA (Victoria)—The second 5-ton skip put in commission to the 24th level, bottom of shaft; replaces 2½-ton skips formerly used. Sinking started again below the 26th level.

WINONA (Winona)—Working two shafts, No. 1 and No. 4, both shifts, but not able to secure enough men for second shift at No. 3 shaft. Rich rock coming from No. 1 shaft.

OSCEOLA CONSOLIDATED (Osceola)—Old Osceola branch continues to show improved quality of rock, but total shipments from all branches were not up to normal during October.

NEW ARCADIAN (Houghton)—Has begun crosscut on 1,500-ft. level to the New Arcadian lode. Delay in getting new crusher prevents completion of new shaft house or use of new hoisting engine.

ADVENTURE (Greenland)—Shaft repaired, new piping run, compressor working and ground being opened. Rock showing good. Stamping has not yet started but more men are going underground. Mine was shut down 14 years ago, when in fair rock.

CALUMET & HECLA (Calumet)—Production for October was 6,633,499 lb., and from subsidiaries, as follows: Ahmeek, 1,976,977 lb.; Allouez, 984,136; Centennial, 190,600; Isle Royale, 1,035,580; La Salle, 121,432; Osceola, 1,555,021; Superior, 221,162; Tamarack, 582,225; White Pine, 374,466 lb.

## MISSOURI

### Joplin District

STARK CITY (Stark City)—Opened up rich shallow ground on Kilgore land, near town.

PELICAN ZINC (Joplin)—New company organized to take over Cock Robin property, at Chitwood.

MONT B (Webb City)—Operating again after two months' shutdown. Is one of largest sheet-ground mines.

ACME MINING AND MILLING (Joplin)—Has made good strikes north of Carl Junction and is starting shafts.

YELLOW PUP (Zincite)—Opening up new run of ore to northwest of old workings and expect to operate mill full shift again soon.

REBEKAH (Commerce, Okla.)—To erect new mill on 250-acre tract four miles north of Commerce. W. A. Wood, general manager.

C. C. McCORMICK (Aurora)—In searching for zinc, opened 12-ft. face of "Venetian Red" paint, on farm south of Aurora. Expects to develop.

CARMEAN & SQUIRES (Webb City)—Have taken over Old Virginia mine south of Carterville. It is their sixth sheet-ground property.

KING JACK (Commerce, Okla,)—Another cave-in, in which a rougher jig and set of rolls were lost, has caused final abandonment.

SPENCER & CO. (Joplin)—One sludge plant going and will construct another to work sands from A. W. C. properties. J. S. Spencer, Webb City, manager.

H. D. SKELTON (Miami, Okla.)—Expects to erect two new mills on tracts he and associates are developing northeast of Picher, Okla., near Baxter Springs. Drilling continues but two shafts have been started.

RED BIRD (Webb City)—New mill recently completed now in operation and good returns being made. Owned by Curtis, Cosden & Aitken interests of Tulsa, Okla. W. B. Shackelford, of Webb City, manager.

## MONTANA

### Beaverhead County

NATIONAL OIL CO. (Dillon)—Reported that oil has been struck in Sheep Creek basin near Dell. Well 750 ft. deep.

ORIGINAL BANNACK MINING (Bannack)—At depth of 150 ft. a 50-ft. vein carrying about 1½% copper and $2 in gold was opened. Development to be continued through winter and if satisfactory, mill will be erected in spring. John F. Cowan, Salt Lake City, Utah, consulting engineer.

### Fergus County

BARNES KING (Kendall)—Third quarterly report shows profit $23,606 on Shannon property in Marysville district, Lewis and Clark County. Losses on Piegan Gloster, in same district, on Woodrow Wilson in Rimini district and on North Moccasin and Kendall in Fergus County and miscellaneous expenses amounted to $17,148, leaving net profit for quarter of $6,458. During period another $30,000 was paid in Kendall property, completing purchase. With this item out of the way, and with many improvements made at Shannon and Piegan-Gloster properties, it is expected that both output and earnings will increase.

### Jefferson County

CRYSTAL COPPER (Basin)—On Cataract Creek, 8 mi. north of Basin, No. 2 crosscut tunnel, now being driven; expected to intercept vein in 60 days.

### Mineral County

RICHMOND MINING, MILLING AND REDUCTION (Saltese)—Shipping carload a day. Contract for hauling ore 6 mi. to railroad let. About 1,000 tons of ore broken in stopes, ready for removal.

### Silver Bow County

BUTTE & SUPERIOR MINING CO. (Butte)—Present indications are that production during last quarter will exceed preceding quarter, which was poorest made by company in two years. Many improvements now nearing completion for handling

ore. Development on 1,700 and 1,800 levels shows continuation of orebodies found on upper levels. This with orebodies developed in upper levels gave an additional of 186,000 tons to ore reserve. Most promising feature is continued extension of orebodies to the east of former workings.

ANACONDA (Butte)—Preparing to sink 1,000-ft. shaft on Bonanza claim, ½ mi. southwest of Emma mine. Bonanza was recently acquired and prospected by company and decision to sink shaft indicates that exploration proved satisfactory. Work at Emma mine progressing rapidly; reported large bodies of zinc ore blocked out down to the 800 level. Crosscut now being driven from company's Gagnon mine will intercept these orebodies 800 ft. below this and may double the reserves now in sight. It is intention to bring mine up to a producing basis of 400 tons of zinc ore a day, with ability to increase output whenever demand requires.

## NEVADA

### Churchill County

NEVADA WONDER (Wonder)—During year ended Sept. 30, milled 57,281 tons of ore, average value $14.86 per ton; recovery, 92.72%. Mining expenses, $295,958; milling, $187,046; marketing, $14,661; metal losses at milling, $61,950; sinking subshaft, $10,374; general expenses, $1,840; net operating profit, $279,264; dividends paid, $211,-251. Orebody opened on 1,300-ft. level; milling grade ore being developed on 1,600 level, reached by subshaft; some sulphide ore also found on this level. September mill recovery, 94.22%.

### Esmeralda County

GRANDMA CONSOLIDATED (Goldfield)—Has acquired control of Gold Sunrise property, adjoining on east. Proposes to absorb latter company by exchange of stock.

REORGANIZED CRACKERJACK (Goldfield)—Recent report covering June 1 to Nov. 1 states 1,355 ft. development work done, exposing above the 120-ft. level considerable low-grade ore.

FLORENCE (Goldfield)—Following recent visit of President A. D. Parker, operations at mine and mill were suspended. Present stopes and faces were not yielding ore of a profitable grade. Deep development may be undertaken.

### Lyon County

NEVADA-DOUGLAS COPPER (Ludwig)—Main leaching plant started Nov. 5. About 30 cars of high-grade ore shipped in October.

### Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 11 was 9,757 tons, valued at $191,566, compared wtih 10,176 tons for week previous. Producers were: Tonopah Belmont, 2,810 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,050; Jim Butler, 1,150; West End, 794; Halifax, 215; Rescue-Eula, 189; McNamara, 54; leases, 115 tons.

MONARCH-PITTSBURGH (Tonopah) — Raise from 1,000-ft. level continues to show ore of fair grade. Trial shipment of 90 tons made to the West End mill.

TONOPAH BELMONT (Tonopah)—Now have two diamond drills and one churn drill at work prospecting area included in various groups recently acquired in eastern section of district.

MONARCH-PITTSBURGH (Tonopah)—Oreshoot encountered in raise from 1,000-ft. level at height of about 100 ft. Stated to average $30 across 3 ft. Raise will be continued to 850-ft. level for air connection.

ORIZABA (Millers)—Control of this mine held by Diamondfield Black Butte company, of Goldfield. Ore of shipping grade now exposed in both east and west drifts on 100-ft. level and shipments are being sent by auto truck to railroad.

TONOPAH EXTENSION (Tonopah)—Three lines of development of major importance being conducted from 1,540-ft. level of Victor shaft; the long crosscut to the Afterall company's ground, the northerly crosscut towards the Sully group and the deepening of the Victor shaft to the 1,850-ft. level.

### Storey County

ANDES (Virginia)—Saved 56 cars of ore from 350-ft. level.

OPHIR (Virginia)—North drift 2,700 level advanced to 421-ft. point.

CON. VIRGINIA (Virginia)—Joint west crosscut extended to 338-ft. point. Repairs made in man shaft.

MEXICAN (Virginia)—Repairs made in shaft and west crosscut on 2,500 level advanced to 472 ft.; face in quartz and porphyry.

JACKET (Gold Hill)—Cyanide plant, 16 mills and 3 tables operated; 603 tons dump rock put in mill bins; bar of bullion shipped.

UNION CON. (Virginia)—Extracted from 2,500 level 118 cars of ore, $10.60 per ton; 38 cars, $21.30 per ton. Rapid advancement in development and sampling on 2,300, 2,400, 2,500, 2,700 levels.

SIERRA NEVADA (Virginia)—Jointly with Union east crosscut from 2,600 station advanced to 244-ft. point. Old north drift 2,500 level advanced to 124 ft. Connection made with 2,400-2,500 raise.

## NEW MEXICO

### Grant County

CHINO (Hurley)—Seven trains of 28 cars each, averaging 55 tons to the car, hauled daily from mines at Santa Rita to mills at Hurley.

EL PASO MINING CO. (Pinos Altos)—New organization of El Paso and Pinos Altos men to consolidate some old gold properties, and erect mill.

CLIFTON (Mogollon)—Oaks Co. driving south drift from adit level and raising on No. 1 orebody. Last shipment to custom mill assayed $14 per ton.

EUREKA (Mogollon)—D. E. Bearup, owner and operator, made rich strike recently; scouring camp for burros to pack accumulation of mill ore to local custom works; richer ore being sacked for shipment to smelters.

SANTA RITA DEVELOPMENT (Santa Rita)—Larger hoist and compressor for No. 1 shaft purchased; contract let for driving prospect drift in extreme south end of property; two Cyclone churn drills arrived; new office building ready and assay outfit ordered. Ruddle shaft unwatered; two cars ore ready for shipment.

LITTLE FANNIE (Mogollon)—Socorro Mining and Milling Co., operator, has installed automatic scale at mill terminal of aërial tramway from Pacific mine for weighing all ore received from latter property. Belt conveyor being placed to handle this ore between receiving bins and crusher. Bullion output for October was 4,100 lb.; ore treated 7,000 tons.

LAST CHANCE (Mogollon)—Timbering of new 960-ft. shaft below 500-ft. level progressing rapidly, work being conducted from two different points. Development will be pushed from both 800- and 900-ft. levels as soon as timbering will permit. Mogollon Mines Co., operating property, shipped during October 2,800 lb. gold-silver bullion from treatment of 4,100 tons.

## TENNESSEE

TENNESSEE COPPER (Copperhill)—Suit was filed in the Supreme Court in New York, on Nov. 17, by 15 fire-insurance companies to prevent collection of $750,000 damage resulting from destruction by fire, on Mar. 20, of the company's trinitrotoluol plant near Fox Hill, Tenn. Insurance companies claim to have been unaware of the nature of the product and that their inspector was not shown this plant while in the Fox Hill district.

## UTAH

### Beaver County

KING DAVID (Frisco)—Diamond drilling being done on the 800 level; hole down 100 ft. Some lead and zinc ore being opened in western part of ground.

INDIAN QUEEN (Frisco)—Contract for 100 ft. of drifting from old Indian Queen tunnel given to J. Nielson. Lessees working in one part of property. Three cars of ore shipped recently.

### Box Elder County

LAKEVIEW (Saline)—Car of ore running well in lead and silver settled for. November shipments expected to be nine cars of silver-lead and four cars of high-grade zinc. Eight sets of lessees working.

### Juab County

MONTANA MINING (Eureka)—Company owning property not far from Tintic Standard to be reorganized. Adjoins Iron King. Has two-compartment working shaft and modern equipment. Expected to resume work.

CHIEF CONSOLIDATED (Eureka) — Drifting being done from shaft on 52-ft. level, north and south, on this company's Homansville property. Work during month has not increased water flow; small pump still adequate.

YANKEE (Eureka)—High-grade ore cut in shaft in Humbug ground. Ore along north-south break near Jesse Knight-Humbug stope, from which large amount of ore produced. New ore runs high in silver, and carries gold and lead, some of it to be sacked for shipment.

TINTIC MILLING (Silver City)—Mill treating approximately 200 tons of ore a day. Six of new roasters installed. New leaching plant will be completed in two weeks; rated capacity, 300 tons. At present ores, largely from Knight properties, being treated; more custom ores will be treated when 300-ton capacity is reached.

EAGLE & BLUE BELL (Eureka)—Shaft down 2,000 ft., and being continued to 2,050 ft., below which water is looked for. Station to be cut and drifting done just above water level. Drifting—under contract to Walter Fitch, Jr.—to be started on 1,200 of Victoria, going through Victoria and Eagle & Blue Bell into Plutus ground (latter controlled by Chief). Companies to share jointly in expense.

### Piute County

PITTSBURGH-UTAH POTASH CO. (Marysvale)—Incorporated under laws of Delaware to operate alunite property comprising 17 claims near Sevier River; Charles J. Petgen, of Pittsburgh, is president and manager. James Long, Jr., is in charge of the property in Utah. A 20-ton plant contemplated.

DE WITT (Marysvale)—On these claims in Bullion Cañon, near Bully Boy & Webster, opened ore on main vein at three points—total distance of 150 ft.; gold-silver-copper-lead ore 3 or 4 ft. in thickness followed down 35 ft.

POTASH CO. OF UTAH (Marysvale)—Articles of incorporation soon to be filed. Capitalization to be 1,500,000 shares. Object to develop alunite claims adjoining Mineral Products corporation at Marysvale. B. H. Payne, of San Francisco, F. B. McCarthy, of Philadelphia, Boies Penrose, W. W. Byrne, H. W. Clark and others are interested.

### Salt Lake County

ORE CONGESTION at Tanner's Flat below Alta, continues, owing to team shortage. Three cars daily are being sent out; heaviest shippers are South Hecla and Michigan-Utah.

SELLS (Alta)—Car of lead-silver ore shipped, and another broken in mine. Ore coming from No. 1 raise and being taken out in development. A. C. Jacobson, manager.

EAST HECLA (Alta)—Improved conditions in new tunnel between 100- and 150-ft. point. Expected to reach vein—showing good ore further up hill—within 25 ft. Property lies between South Hecla and Mineral Flat, ½ mi. southeast from Alta townsite. D. J. Cook, superintendent.

### Summit County

PARK CITY SHIPMENTS in October amounted to 8,201 tons. Shippers were: Silver King Coalition, Ontario, Federal Leasing, Daly, Utah Ore Sampling, Iowa Copper, Silver King Consolidated, Daly West, Big Four Exploration, New Quincy, Jones and Mines Development.

NEW QUINCY (Park City)—Ore being mined in three places. New ore in west workings promising and has been followed 60 ft. Two cars shipped.

JUDGE MINING AND SMELTING (Park City)—Machinery and tanks for new electrolytic-zinc plant arriving and being placed in position. Expected to be operating early in year. M. H. Kuryla in charge.

SILVER KING CONSOLIDATED (Park City)—Carbonate stope, between 1,550 and 1,625-ft. levels, north from incline, promising. New tramway, eliminating wagon-haul, operating smoothly; 500 tons of second-class sent down to mill. Thaynes cañon tunnel in 960 ft

BIG FOUR EXPLORATION (Park City)—Mill handling 700 tons of tailings daily and making zinc concentrates of good grade. Recent experiments indicate savings can be raised to 55% zinc and approximately $4 in gold, silver and lead by comparatively inexpensive changes.

### Tooele County

LION HILL (Ophir)—Shipments of high-grade silver ore to be resumed. George St. Clair, superintendent.

## CANADA

### British Columbia

GRANBY CONSOLIDATED (Anyox)—Treated in October about 82,000 tons.

PIONEER (Lilloot)—A. F. Noel, in charge of this property, brought out gold bullion recently valued at $5,800.

SILVER KING (Nelson)—Consolidated Mining and Smelting Co., of Trail, has let contract for 1,000 ft. of drifting on Toad Mountain.

LUCKY JIM (Slocan)—A. G. Larson, receiver, has contracted with Consolidated Mining and Smelting Co. for treatment of 600 tons of zinc concentrates monthly for one year. This is first contract entered into for customs ores since erection of the Trail electrolytic zinc plant, which has been treating ores of its Sullivan mine exclusively.

### Ontario

McINTYRE (Schumacher) — October earnings were over $60,000.

KERR LAKE (Cobalt)—Produced in October 210,073 oz. of silver.

TEMISKAMING (Cobalt)—Shipping car of high-grade ore that is expected to return $200,000.

DAVIDSON (Porcupine)—Cut main vein at 300-ft. level where it shows some free gold.

MINAKER (Kirkland Lake) — This property south of the Lake Shore, purchased by Rochester men.

WRIGHT-HARGRAVES (Kirkland Lake)—Has opened extension of main vein showing 9 ft. of $40 ore.

DOME LAKE (South Porcupine)—Mill started again after shutdown of several months; treating about 70 tons a day.

NIPISSING (Cobalt)—In October produced ore of estimated net value of $233,646; bullion from Nipissing and customs ore, $410,233.

McKANE (Kirkland Lake)—Orebody on 400-ft. level shows 40 ft. of ore. Beaver Consolidated of Cobalt will exercise its option.

TRETHEWEY (Cobalt)—Now making a profit of about $8,000 a month.

McKINLEY-DARRAGH (Cobalt)—Decided to close Savage mine, which has been substantial producer for some years.

JUPITER (Schumacher)—Receiving about $5,000 a month from ore treated in McIntyre mill. It is stated that amalgamation of McIntyre, Jupiter and McIntyre Extension will not be consummated

# The Market Report

## Metal Markets

**NEW YORK—Nov. 22, 1916**

Again there was a week of great activity in all of the metal markets, accompanied by advancing prices, but toward the close there seemed to be an abatement of the tempest in copper.

### Copper, Tin, Lead and Zinc

**Copper**—Copper continued to advance furiously on insistent demand of the same kind that was reported last week. The major market was distinctly for delivery in the second quarter of 1917. There began to be some sales for June-July on the part of producers who had sold out everything up to June. The market seemed to culminate on Saturday, Nov. 18. At that time business in second-quarter copper was done in large volume at 32¼c., net cash, New York. Prompt copper was quoted at 34@35c. These quotations remained unchanged during the rest of the week.

The aggregate of business done last week was very much less than in the previous week, and the major part of it was done during the first three days. Following them transactions became rather light and, indeed, the market might be called dull, some producers reporting no sales for three days running. Present views of the market are rather conflicting, some producers reporting consumers being desirous of buying if they could get what they want; while, on the other hand, there are reports of consumers admitting that they are uncovered for the second quarter of 1917 and expressing intention of waiting. Following the crazy and tempestuous buying of the first half of November, it is but natural that calm should ensue.

Price of London electrolytic copper for Nov. 15, was 153½, instead of 153 as published last week.

**Copper Sheets**—Base price for copper sheets is 41c. for hot rolled and 42c. for cold rolled. Copper wire is now at 39@40c. for prompt and 38¾c. for December.

**Tin**—An active business was done, especially on Nov. 20, when transactions were large. At the beginning of the week, spot was 45¼c.; futures, 43¼c. At the close spot was 45⅝c.; futures, 43⅜c.

Exports of Bolivian tin ore, concentrates and bars for the nine months ended Sept. 30, were equivalent to 14,790 tons fine tin. Exports to the United States, included in the total, were 4,911 metric tons concentrates, equivalent to 2,900 tons fine tin.

Receipts of tin ore and concentrates from Bolivia at Liverpool in September were equivalent to 1,093 tons metallic tin; from Nigeria, 333 tons.

Shipments of tin from the Straits in September were 3,345 gross tons.

**Lead**—This market was very strong on large buying from many quarters; while, moreover, sympathy with the advance in copper no doubt played a part. Canada continued to be a buyer, while there were further inquiries from Russia, Japan and China, and some sales to them. On Nov. 20 independent producers began to realize premiums over the price of the A. S. and R. Co.

**Spelter**—A large business was done, both in common and brass special, at advancing prices. Transactions were divided between November-December and first-quarter delivery. Some large transactions for January-June delivery were made. The strength in the spelter market is variously explained. Production is undoubtedly very large. At present buying also is good. One theory is that sellers are holding stiffly in anticipation of a diminished production with the advent of cold weather. The other theory is that the advance in spelter is chiefly in sympathy with the rise in copper.

**Zinc Sheets**—The base price of zinc sheets has advanced twice during the week. On Nov. 17 it was placed at 18 per 100 lb., and on Nov. 20, at $19 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

### Other Metals

**NEW YORK—Nov. 22**

**Antimony**—Market rose sharply, business being done at 14½c. on Nov. 21. Stocks have been about cleaned out and producers are expecting higher prices, which will probably result if any considerable buying develops. At the close we quote 14½@14¾c.

**Quicksilver**—Market firm at $80. Demand fair. San Francisco reports, by telegraph, $76, market steady.

**Aluminum**—The price of No. 1 ingots remains nominal at 64@66c. per lb. New York.

**Nickel**—Shot and ingot nickel remains a 45@50c. per lb.; electrolytic commanding a premium of 5c.

## Gold, Silver and Platinum

**NEW YORK—Nov. 22**

**Gold**—The holding by the Bank of England against its note issues shows an increase of £248,695, as compared with last week's return, according to Samuel Montagu & Co., London, Nov. 2, 1916.

**Silver**—The market has been very broad with an advancing tendency. Recent information is to the effect that considerable shipments of silver have been made from San Francisco to the East—so that the depression caused by China being a selling factor has changed to a healthier tone by purchases for Eastern account by China in way of replacement.

The tendency of prices has been upward, according to Samuel Montagu & Co., London, Nov. 2. On Oct. 28 32¼d. was recorded and on Oct. 31, 32½d. The price remained at this figure until today when offerings being somewhat freer a reaction of $\frac{1}{16}$ took place. The upward movement was encouraged by buying on account of the Indian Bazaars, and also by some inquiry by China. The importance of this latter, as an indication of market tendency, does not depend so much upon its size as upon the fact of its occurrence, and the possibility of its recurrence on a more substantial scale.

The stock in London on Oct. 27 consisted of about 7¾ million standard oz.—an increase since last month of about ¾ million standard oz.

The stock in Shanghai on Oct. 28 consisted of about 23,000,000 oz. in sycee and $16,400,000, as compared with about 24,000,000 oz. in sycee and $16,500,000 dollars on Oct. 14, 1916. The stock in Bombay consists of 4,000 bars the same as last week.

**Platinum**—Price has risen to $105 per oz.

**Palladium**—Unchanged at $75 per oz.

## Zinc and Lead Ore Markets

**Platteville, Wis., Nov. 18, 1916**—Quotations for the district are according to the following prices: Base price per 2,000-lb. ton for material assaying 60% zinc was $93 for premium ore down to $85 for medium grades. For material assaying 80% lead the base price per 2,000-lb. ton was $84. Shipments for the week were: 2,883 tons of zinc ore, 107 tons of lead ore, and 698 tons of sulphur ore. For the year to date the figures are: 115,799 tons of zinc ore, 3,901 tons of lead ore, and 28,395 tons of sulphur ore. Shipped during the week to separating plants, 2,577 tons of zinc ore.

**Joplin, Mo., Nov. 18**—Price quotations per 2,000 lb.: Blende, high $96.90; 60% zinc, premium ore, $95, medium grades, $93@85; low, $80. Calamine, per ton 40% zinc, $55@45. Average selling price, all grades of zinc, $78.26 per ton.

Lead, high price, $88.75; base, $88@84. Average selling price, all grades of lead, $85.75 per ton.

Shipments of the week: Blende, 6,227 tons; calamine, 686 tons; lead, 1,060 tons. Value, all ores the week, $631,950; 46 weeks, $32,768,980.

Offerings of $80 base for 54% zinc on Thursday gave the market an impetus upward, and on that day Granby holders of high-grade calamine refused $55 base.

Outputting conditions continue unsatisfactory, caused by scarcity of water for wet concentration, and the low stage of stream water has reduced the hydro-electric power 5,000 hp. A severe cold snap early in the week lowered the natural gas pressure to the detriment of both mining and smelting interests.

## Other Ores

**Tungsten Ore**—Large sales at $17@17.50 per unit. Market closes firm at the latter figure.

**Molybdenum Ore**—Good demand. Supplies still small. Sellers ask $1.85 per unit.

**Manganese Ore**—Manganese ore imported to the United States in August this year were reported at 76,721 gross tons, against 81,942 tons in July. August receipts are next to the largest this year, those of May being third at 74,825 tons. The total of imports for the eight months to Sept. 1 was 395,686 tons, compared with 145,003 tons to Sept. 1, 1915, and 183,029 tons to Sept. 1, 1914. The average monthly rate thus far this year is 49,460 tons against 28,757 tons in 1913, the previous record, and 22,470 tons as the average for the five-year period from 1910 to 1915. Manganese-ore imports to the United States are now in excess of those to Great Britain, which, for the first nine months of this year, were 348,394 tons.

Imports at Baltimore included 14,690 tons of manganese ore from Brazil and 1,000 tons from Capetown.

## Iron Trade Review

**NEW YORK—Nov. 22**

It is considered that there is some doubt about the kind of deliveries the mills will make on rails ordered for the first half of 1917. The British inquiry for nearly 1,000 mi. of 75-lb. rails carries an attractive profit, but it seems doubtful, even with 1917 deliveries permissible, if the 135,000

### SILVER AND STERLING EXCHANGE

| Nov. | Sterling Exchange | Silver New York, Cents | Silver London, Pence | Nov. | Sterling, Exchange | Silver New York, Cents | Silver London, Pence |
|---|---|---|---|---|---|---|---|
| 16 | 4.7569 | 71⅛ | 34 | 20 | 4.7569 | 72⅛ | 34⅛ |
| 17 | 4.7569 | 71⅛ | 34 | 21 | 4.7569 | 72⅛ | 34⅛ |
| 18 | 4.7569 | 71⅛ | 34⅛ | 22 | 4.7569 | 72⅛ | 34⅛ |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

### DAILY PRICES OF METALS IN NEW YORK

| Nov. | Copper Electrolytic | Tin Spot. | Lead N. Y. | Lead St. L. | Zinc St. L. |
|---|---|---|---|---|---|
| 16 | 30½ @31½ | 45½ | 7.00 | 6.85 @6.92½ | 11 @11½ |
| 17 | 31 @32 | 45½ | 7.00 | 6.85 @6.92½ | 11½ @12 |
| 18 | 32 @32½ | 45½ | 7.00 | 6.85 @7.00 | 11½ @12 |
| 20 | 32 @32½ | 45½ | 7.00 @7.125 | 6.90 @7.00 | 11½ @12½ |
| 21 | 32 @32½ | 45½ | 7.00 @7.15 | 6.90 @7.15 | 12 @12½ |
| 22 | 32 @32½ | 45½ | 7.00 @7.25 | 6.90 @7.15 | 12 @12½ |

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

### LONDON

| Nov. | Copper Standard Spot | Copper Standard 3 Mos. | Copper Electrolytic | Tin Spot | Tin 3 Mos. | Lead Spot | Zinc Spot |
|---|---|---|---|---|---|---|---|
| 16 | 135 | 130½ | 154 | 189 | 190¾ | 30½ | 56¾ |
| 17 | 139 | 135 | 158 | 188¾ | 190¼ | 30½ | 57½ |
| 18 | .... | .... | 158 | .... | .... | .... | .... |
| 20 | 141 | 136½ | 160 | 188½ | 190½ | 30½ | 56½ |
| 21 | 144 | 139½ | 163 | 188¾ | 190¾ | 30½ | 56½ |
| 22 | 144 | 139½ | 164 | 191 | 193 | 30½ | 57½ |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½ cents.

tons involved can be placed in this country. The fact is that the demand is strong for steel products carrying 50 to 200% larger profits than rails, this factor seriously influencing the manufacture and delivery of rails. The shortage of cars in railroad service is serious, but probably is matched by the shortage of motive power.

### PITTSBURGH—Nov. 21

Yesterday afternoon the Carnegie Steel Co. advanced bars $4 a ton to 2.90c., shapes $4 a ton to 3c. and plates $5 a ton to 3.50c. Other producers took similar action the moment they heard of the advances. The National Tube Co. yesterday advanced base sizes of steel boiler tubes six points or about $12 a ton and one other size five points. Black sheets are up $7 a ton and galvanized sheets $10 a ton, to 4c. and 5.50c. respectively, while tinplates are up $15 a ton to $7 per base box.

Steel prices are advancing more rapidly than ever in this remarkable movement. The advance since December, 1914, is now three times the amount it required to bring prices up to the level of 1907, the highest level in the market from 1902 to the beginning of this year.

Earlier in this movement the mills suggested that they were advancing prices to check buying as they did not wish their order books to become overloaded. Now they seem to be advancing prices because enough buyers are indifferent to prices to keep their order books replenished as the present heavy shipments are made. Export sales are not particularly heavy but it appears that if domestic buyers should drop out of the market foreign buyers would take all the tonnage thus relinquished.

Car shortages continue in evidence, but as a rule shipments of steel products have been made with somewhat more facility in the past week than formerly. Box cars are not as scarce as flats and gondolas. The weather has been exceptionally favorable for the season, and a real cold snap, especially if accompanied by snow, would probably tie up the railroads and cause a congestion of material at mills that would operate to curtail production.

**Pig Iron**—Sales for the second half of 1917 are more common, and quite a considerable tonnage of basic is now under cover for the period, the first sales having been at $24, valley. There is no price distinction as to deliveries. In all grades prices show a sharp advancing tendency. Bessemer is up $1 and foundry $2. We quote: Bessemer, $31; basic, $26@27; foundry and malleable, $27@28; forge, $26.50@27.50, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

**Iron Ore**—It is probable that sales of Lake Superior iron ore for the season of 1917 will start tomorrow or next day, at about $1.30 advance from 1916 prices, which were 65 to 70c. above those for 1915 and 1914. The new prices would then be: Old range bessemer, $5.75; nonbessemer, $5; Mesabi bessemer, $5.50; nonbessemer, $4.85, on Lake Erie docks. Late last week large chartering of vessels for 1917 fixed the rate at $1 net to the vessels, against 50c. for 1916, paving the way for a fixing of ore prices.

**Steel**—The market, as far as quotable at all, is about $5 a ton higher, at about $55 for billets or sheet bars, but transactions are light, there being scarcely any steel available. Rods are higher, it being possible to obtain from $65 to $70. Forging billets are $70@75.

## Coke

**Connellsville**—The recent large buyers of spot furnace coke remain out of the market, pursuing their intention of not paying fancy prices. Scattered inquiry resulted today in sales of small lots at $6.50 and at $7. Contract furnace coke is nominal, last contracts being at about $4. Spot foundry is bringing $9.50@10 and contract $5.50@6.50. Cars continue scarce.

## Ferroalloys

**Ferromanganese**—The market has turned strong and the shading appears to be over. We quote imported on contract at $164 and domestic on contract at $165, with prompt at $165.

## Chemicals

### NEW YORK—Nov. 22

The general market continues firm. A steady demand continues for soda ash and caustic soda. The explosive acids including sulphuric and nitric are firm notwithstanding increased production.

**Arsenic**—White quoted 6@6¼c. per lb., red arsenic, 55@60c. per lb., 6c. in kegs of 200 lb.

**Bleaching Powder**—Quoted $4.75@5 in 100-lb. drums.

**Sulphur**—Crude quoted $28.50@29 per ton; roll, $1.95@2.25 per 100 lb.

**Potassium Carbonate**—Quoted at $1.30@1.35 per lb.

**Soda Ash**—Quoted 3@3⅝c. per lb. for 48%.

**Nitric Acid**—Quoted $7.50@8 for spot.

## STOCK QUOTATIONS

| N. Y. EXCH.† | Nov. 21 |
|---|---|
| Alaska Gold M. | 12⅛ |
| Alaska Juneau | 8 |
| Am.Sm.&Ref.,com. | 122⅜ |
| Am. Sm. & Ref., pf. | 116¼ |
| Am. Sm. Sec., pf. A | 101 |
| Am. Sm. Sec., pf. B. | 97 |
| Am. Zinc | 61⅞ |
| Am. Zinc, pf. | 82 |
| Anaconda | 102½ |
| Batopilas Min. | 2 |
| Bethlehem Steel | 680 |
| Bethlehem Steel, pf. | 160 |
| Butte & Superior | 71 |
| Chile Cop. | 33 |
| Chino | 69⅛ |
| Colo.Fuel & Iron | 58⅛ |
| Crucible Steel | 88⅛ |
| Dome Mines | 23½ |
| Federal M. & S. | 16 |
| Federal M. & S., pf. | 49 |
| Great Nor., ore ctf. | 48½ |
| Greene Cananea | 54 |
| Homestake | 130 |
| Inspiration Con. | 71½ |
| International Nickel | 47½ |
| Kennecott | 59½ |
| Lackawanna Steel | 103½ |
| Miami Copper | 47½ |
| Nat'l Lead, com. | 69 |
| National Lead, pf. | 115 |
| Nev. Consol. | 30⅛ |
| Ontario Min. | 6 |
| Quicksilver | 2½ |
| Quicksilver, pf. | 2 |
| Ray Con. | 33½ |
| Republic I.&S.,com. | 90 |
| Republic I. & S. pf. | 115 |
| Sloss-Sheffield | 87½ |
| Tennessee Copper | 24⅛ |
| U. S. Steel, com. | 122 |
| U. S. Steel, pf. | 125 |
| Utah Copper | 125 |
| Va. Iron C. & C. | 66 |

| N. Y. CURB† | Nov. 21 |
|---|---|
| Buffalo Mines | 1.15 |
| Butte & N. Y. | 2⅛ |
| Butte C. & Z. | 15¼ |
| Caledonia | .55 |
| Can. Cop. Corpn. | 2½ |
| Cashboy | .06 |
| Cerro de Pasco | 44½ |
| Con. Ariz. Sm. | 2⅛ |
| Con. Coppermines | 3⅛ |
| Con. Nev.-Utah | ⅛ |
| Crystal Cop. | 1 |
| First Nat. Cop. | 5½ |
| Florence | .70 |
| Goldfield Con. | .52 |
| Goldfield Merger | .06 |
| Granite | .43 |
| Hecla Min. | 8½ |
| Howe Sound | 8½ |
| Jerome Verde | 1⅛ |
| Joplin Ore & Spel. | .50 |
| Kerr Lake | 5 |
| Magma | 60 |
| Majestic | ⅛ |
| McKinley-Dar-Sa. | .58 |
| Mother Lode | .38½ |
| Nevada Hills | .21 |
| N. Y. & Hond. | 16½ |
| Nipissing Mines | 9½ |
| Oro | ‡.03½ |
| Ray Hercules | 6 |
| Rochester Mines | .77 |
| St. Joseph Lead | 21½ |
| Standard S. L. | 1⅛ |
| Stewart | .28½ |
| Success | .49 |
| Tonopah | 6 |
| Tonopah Ex. | 5½ |
| Tribullion | ⅛ |
| United Zinc | 5½ |
| White Knob, pf. | 2½ |
| White Oaks | 4 |
| Yukon Gold | 2½ |

| SAN FRAN.* | Nov. 21 |
|---|---|
| Alta | .04 |
| Andes | .09 |
| Best & Belcher | .05 |
| Bullion | .02 |
| Caledonia | .25 |
| Challenge Con. | .05 |
| Confidence | .20 |
| Cons. Imperial | ‡.01 |
| Con. Virginia | .07 |
| Gould & Curry | .03 |
| Hale & Norcross | .07 |
| Jacket-Cr. Pt. | .03 |
| Mexican | .07 |
| Occidental | .65 |
| Ophir | .16 |
| Overman | .03 |
| Savage | .07 |
| Seg Belcher | .02 |
| Sierra Nevada | .25 |
| Union Con. | .52 |
| Utah Con. | .02 |
| Belmont | 4.60 |
| Jim Butler | .92 |
| MacNamara | .07 |
| Midway | .22 |
| Mont.-Tonopah | .22 |
| North Star | .16 |
| Rescue Eula | .28 |
| West End Con. | .70 |
| Atlanta | .07 |
| Booth | .07 |
| C.O.D. Con. | .02 |
| Comb. Frac. | .04 |
| D'field B.B. | .05 |
| D'field Daisy | ‡.05 |
| Jumbo Extension | .22 |
| Round Mountain | .35 |
| Sandstorm Kendall | ‡.03 |
| Silver Pick | .22 |
| Central Eureka | ‡.05 |
| Argo | .06 |
| Ariz. Central | .05 |
| Big Jim | 1.43½ |
| Lazy Boy | .06 |
| Nellie | .25 |
| Tom Reed | 2.05 |
| United Eastern | 4.50 |
| United Western | .05 |

| BOSTON EXCH.* | Nov. 21 |
|---|---|
| Adventure | 5⅛ |
| Ahmeek | 122 |
| Algomah | 1½ |
| Allouez | 82 |
| Ariz. Com., ctfs. | 17⅛ |
| Bonanza | .25 |
| Butte-Balaklava | 2⅛ |
| Calumet & Ariz. | 97 |
| Calumet & Hecla | 630 |
| Centennial | 26 |
| Copper Range | 86⅜ |
| Daly West | 3 |
| East Butte | 18½ |
| Franklin | 12½ |
| Granby | 108 |
| Hancock | 21 |
| Helvetia | .85 |
| Indiana | 6½ |
| Island Cr'k, com. | 62 |
| Island Cr'k, pfd. | 91⅜ |
| Isle Royale | 39½ |
| Keweenaw | 6½ |
| Lake | 16½ |
| La Salle | 5 |
| Mason Valley | 7⅛ |
| Mass | 18½ |
| Mayflower | 4½ |
| Michigan | 4½ |
| Mohawk | 105 |
| New Arcadien | 8 |
| New Idria | 16½ |
| North Butte | 29½ |
| North Lake | 2 |
| Ojibway | 2½ |
| Old Colony | 3 |
| Old Dominion | 80½ |
| Osceola | 102 |
| Quincy | 106½ |
| St. Mary's M. L. | ‡91 |
| Santa Fe | 2 |
| Shannon | 10⅛ |
| Shattuck-Ariz. | 34½ |
| So. Lake | 7½ |
| So. Utah | .30 |
| Superior | 20½ |
| Superior & Bost. | 7⅛ |
| Tamarack | 45½ |
| Trinity | 8 |
| Tuolumne | .65 |
| U. S. Smelting | 80 |
| U. S. Smelt'g, pf. | 51½ |
| Utah Apex | 3⅛ |
| Utah Con. | 26⅛ |
| Utah Metal | 7⅛ |
| Victoria | 7⅛ |
| Winona | 7⅛ |
| Wolverine | 55 |
| Wyandot | 2½ |

| BOSTON CURB* | Nov. 21 |
|---|---|
| Alaska Mines Corp. | .86 |
| Bingham Mines | 11⅛ |
| Boston Ely | 105 |
| Boston & Mont. | .80 |
| Butte & Lon'n Dev. | .60 |
| Calaveras | .5 |
| Calumet-Corbin | .02 |
| Chief Con. | 2½ |
| Cortez | .25 |
| Crown Reserve | .42 |
| Davis-Daly | 4⅛ |
| Eagle & Blue Bell | 1⅛ |
| Houghton Copper | 2⅛ |
| Iron Cap Cop., pf. | 10⅛ |
| Mexican Metals | .47 |
| Mines of America | 2⅛ |
| Mojave Tungsten | 2½ |
| Nat. Zinc & Lead | .61 |
| Nevada-Douglas | 1⅛ |
| New Baltic | 3⅞ |
| New Cornelia | 19¼ |
| Ohio Copper | .40 |
| Oneco | 1⅛ |
| Rex Cons. | .65 |
| Rilla | .08 |
| United Verde Ext. | 41⅛ |

| SALT LAKE* | Nov. 21 |
|---|---|
| Big Four | 1.17½ |
| Black Jack | .06 |
| Cardiff | 7.25 |
| Colorado Mining | .22 |
| Crown Point | .05 |
| Daly-Judge | 8.00 |
| Emma Cop. | 2.37½ |
| Empire Copper | 1.45 |
| Gold Chain | .18 |
| Grand Central | .50 |
| Iron Blossom | 1.62½ |
| Lower Mammoth | .03⅞ |
| May Day | .10⅜ |
| Opohongo | ‡.01 |
| Prince Con. | 1.35 |
| Seven Troughs | ‡.04 |
| Silver-King Coal'n | 3.20 |
| Silver King Con. | 4.35 |
| Sioux Con. | .15 |
| So. Hecla | 1.72½ |
| Uncle Sam | .06 |
| Wilbert | .08 |
| Yankee | .22 |

| TORONTO* | Nov. 21 |
|---|---|
| Bailey | .07½ |
| Beaver Con. | .45 |
| Chambers Feriand | .16 |
| Coniagas | 4.85 |
| La Rose | .53 |
| Peterson Lake | .18 |
| Right of Way | .03 |
| Seneca Superior | ‡.09 |
| T. & Hudson Bay | 73.00 |
| Temiskaming | .64 |
| Wettlaufer-Lor. | .07 |
| Dome Exten. | .29 |
| Dome Lake | .58 |
| Foley O'Brien | .70 |
| Hollinger | 6.90 |
| Jupiter | .29 |
| McIntyre | 1.80 |
| Newray | 1.10 |
| Porcu. Crown | .70 |
| Vipond | .37 |
| West Dome | .34 |

## STOCK QUOTATIONS—Continued

| COLO. SPRINGS | Nov. 21 |
|---|---|
| Cresson Con. | 8.60 |
| Doctor Jack Pot. | .08½ |
| Elkton Con. | .12 |
| El Paso | .40 |
| Findlay | .03½ |
| Gold Sovereign | .04 |
| Golden Cycle | 2.58 |
| Granite | .65½ |
| Isabella | .23 |
| Mary McKinney | .28 |
| Portland | 1.90 |
| Vindicator | 1.75 |

| LONDON | Nov. 9 |
|---|---|
| Alaska Mexican | £0 12s 6d |
| Alaska Tre'dwell | 2 17 6 |
| Burma Corp. | 4 0 0 |
| Cam & Motor | 0 11 9 |
| Camp Bird | 0 7 0 |
| El Oro | 0 8 3 |
| Esperanza | 0 10 0 |
| Mexico Mines | 3 15 0 |
| Nechi, pfd. | 0 13 9 |
| Oroville | 0 16 6 |
| Santa Gert'dis | 0 10 9 |
| Tomboy | 1 1 3 |

* Bid prices. † Closing prices. ‡ Last Quotations.

## MONTHLY AVERAGE PRICES OF METALS

| Silver | New York | | | London | | |
|---|---|---|---|---|---|---|
| | 1914 | 1915 | 1916 | 1914 | 1915 | 1916 |
| January | 56.572 | 48.855 | 56.775 | 26.553 | 22.731 | 26.960 |
| February | 57.506 | 48.477 | 56.755 | 26.573 | 22.753 | 26.975 |
| March | 58.067 | 50.241 | 57.935 | 26.788 | 23.708 | 27.597 |
| April | 58.519 | 50.250 | 64.415 | 26.958 | 23.709 | 30.662 |
| May | 58.175 | 49.915 | 74.269 | 26.704 | 23.570 | 35.477 |
| June | 56.471 | 49.034 | 65.024 | 25.948 | 23.267 | 31.060 |
| July | 54.678 | 47.519 | 62.940 | 25.219 | 22.597 | 30.000 |
| August | 54.344 | 47.163 | 66.083 | 25.979 | 22.780 | 31.498 |
| September | 53.290 | 48.680 | 68.515 | 24.260 | 23.591 | 32.584 |
| October | 50.654 | 49.385 | 67.855 | 23.199 | 23.925 | 32.361 |
| November | 49.082 | 51.714 | ..... | 22.703 | 25.094 | ..... |
| Dec. | 49.375 | 54.971 | ..... | 22.900 | 26.373 | ..... |
| Year | 54.811 | 49.684 | ..... | 25.314 | 23.675 | ..... |

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

| Copper | New York | | London | | | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Standard | | Electrolytic | |
| | 1915 | 1916 | 1915 | 1916 | 1915 | 1916 |
| Jan. | 13.641 | 24.008 | 60.756 | 88.083 | 65.719 | 116.167 |
| Feb. | 14.394 | 26.440 | 63.494 | 102.667 | * | 133.167 |
| Mar. | 14.787 | 26.310 | 66.152 | 107.714 | * | 136.000 |
| April | 16.811 | 27.895 | 75.096 | 124.319 | * | 137.389 |
| May | 18.506 | 28.625 | 77.600 | 135.457 | * | 152.522 |
| June | 19.477 | 26.601 | 82.574 | 112.432 | 95.333 | 137.455 |
| July | 18.796 | 23.865 | 76.011 | 95.119 | 91.409 | 125.500 |
| Aug. | 16.941 | 26.120 | 68.673 | 110.283 | 82.333 | 126.304 |
| Sept. | 17.502 | 26.855 | 68.915 | 113.905 | 85.250 | 134.071 |
| Oct. | 17.686 | 27.193 | 72.601 | 122.750 | 88.000 | 142.523 |
| Nov. | 18.627 | ..... | 77.744 | ..... | 93.273 | ..... |
| Dec. | 20.133 | ..... | 80.773 | ..... | 100.430 | ..... |
| Year | 17.275 | ..... | 72.532 | ..... | ..... | ..... |

| Tin | New York | | London | |
|---|---|---|---|---|
| | 1915 | 1916 | 1915 | 1916 |
| January | 34.260 | 41.825 | 156.550 | 175.548 |
| February | 37.415 | 42.717 | 176.925 | 181.107 |
| March | 48.426 | 50.741 | 180.141 | 193.609 |
| April | 47.884 | 51.230 | 166.225 | 199.736 |
| May | 38.790 | 49.125 | 162.675 | 196.511 |
| June | 40.288 | 42.231 | 167.636 | 179.466 |
| July | 37.423 | 38.510 | 167.080 | 168.357 |
| August | 34.389 | 38.565 | 151.440 | 169.870 |
| September | 33.125 | 38.830 | 152.625 | 171.345 |
| October | 33.080 | 41.241 | 151.554 | 179.307 |
| November | 39.224 | ..... | 167.670 | ..... |
| December | 38.779 | ..... | 167.000 | ..... |
| Av. year | 38.590 | ..... | 163.960 | ..... |

| Lead | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1915 | 1916 | 1915 | 1916 | 1915 | 1916 |
| January | 3.729 | 5.921 | 3.548 | 5.826 | 18.606 | 31.167 |
| February | 3.827 | 6.246 | 3.718 | 6.164 | 19.122 | 31.988 |
| March | 4.053 | 7.136 | 3.997 | 7.375 | 21.883 | 34.440 |
| April | 4.221 | 7.630 | 4.142 | 7.655 | 21.094 | 34.368 |
| May | 4.274 | 7.463 | 4.182 | 7.332 | 20.347 | 32.967 |
| June | 5.932 | 6.936 | 5.836 | 6.749 | 25.170 | 31.011 |
| July | 5.659 | 6.352 | 5.531 | 6.185 | 24.611 | 28.137 |
| August | 4.656 | 6.244 | 4.520 | 6.088 | 21.946 | 29.734 |
| September | 4.610 | 6.810 | 4.490 | 6.699 | 23.151 | 30.786 |
| October | 4.600 | 7.000 | 4.499 | 6.898 | 23.994 | 30.716 |
| November | 5.155 | ..... | 5.078 | ..... | 26.278 | ..... |
| December | 5.355 | ..... | 5.266 | ..... | 28.807 | ..... |
| Year | 4.673 | ..... | 4.567 | ..... | 22.917 | ..... |

| Spelter | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1915 | 1916 | 1915 | 1916 | 1915 | 1916 |
| Jan. | 6.386 | 16.915 | 6.211 | 16.745 | 30.844 | 89.810 |
| Feb. | 8.436 | 18.420 | 8.255 | 18.260 | 39.819 | 97.762 |
| Mar. | 8.541 | 16.846 | 8.360 | 16.676 | 44.141 | 95.048 |
| April | 10.012 | 16.695 | 9.837 | 16.525 | 49.888 | 99.056 |
| May | 14.781 | 14.276 | 14.610 | 14.106 | 68.100 | 94.217 |
| June | 21.208 | 11.752 | 21.038 | 11.582 | 100.614 | 68.591 |
| July | 19.026 | 8.925 | 18.856 | 8.755 | 97.250 | 50.750 |
| Aug. | 12.781 | 8.730 | 12.611 | 8.560 | 67.786 | 51.587 |
| Sept. | 13.440 | 8.990 | 13.270 | 8.820 | 67.841 | 52.095 |
| Oct. | 12.800 | 9.829 | 12.596 | 9.659 | 66.536 | 54.159 |
| Nov. | 15.962 | ..... | 15.792 | ..... | 88.409 | ..... |
| Dec. | 15.391 | ..... | 15.221 | ..... | 89.400 | ..... |
| Year | 13.230 | ..... | 13.054 | ..... | 67.553 | ..... |

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

| Pig Iron, Pitts. | Bessemer‡ | | Basic‡ | | No. 2 Foundry | |
|---|---|---|---|---|---|---|
| | 1915 | 1916 | 1915 | 1916 | 1915 | 1916 |
| January | $14.59 | $21.60 | $13.45 | $18.78 | $13.90 | $19.70 |
| February | 14.55 | 21.16 | 13.45 | 18.93 | 13.90 | 19.51 |
| March | 14.55 | 21.81 | 13.45 | 19.20 | 13.95 | 19.45 |
| April | 14.55 | 21.65 | 13.45 | 18.95 | 13.95 | 19.45 |
| May | 14.61 | 21.78 | 13.60 | 19.11 | 13.83 | 19.58 |
| June | 14.70 | 21.95 | 13.67 | 18.95 | 13.77 | 19.34 |
| July | 14.94 | 21.95 | 13.91 | 18.95 | 13.68 | 19.20 |
| August | 16.01 | 21.95 | 15.31 | 18.95 | 14.75 | 19.25 |
| September | 16.86 | 22.88 | 15.95 | 19.58 | 15.70 | 19.53 |
| October | 16.95 | 24.61 | 15.96 | 21.26 | 15.80 | 21.51 |
| November | 17.57 | ..... | 16.47 | ..... | 17.20 | ..... |
| December | 19.97 | ..... | 18.44 | ..... | 18.95 | ..... |
| Year | $15.82 | ..... | $14.76 | ..... | $14.95 | ..... |

‡ As reported by W. P. Snyder & Co.